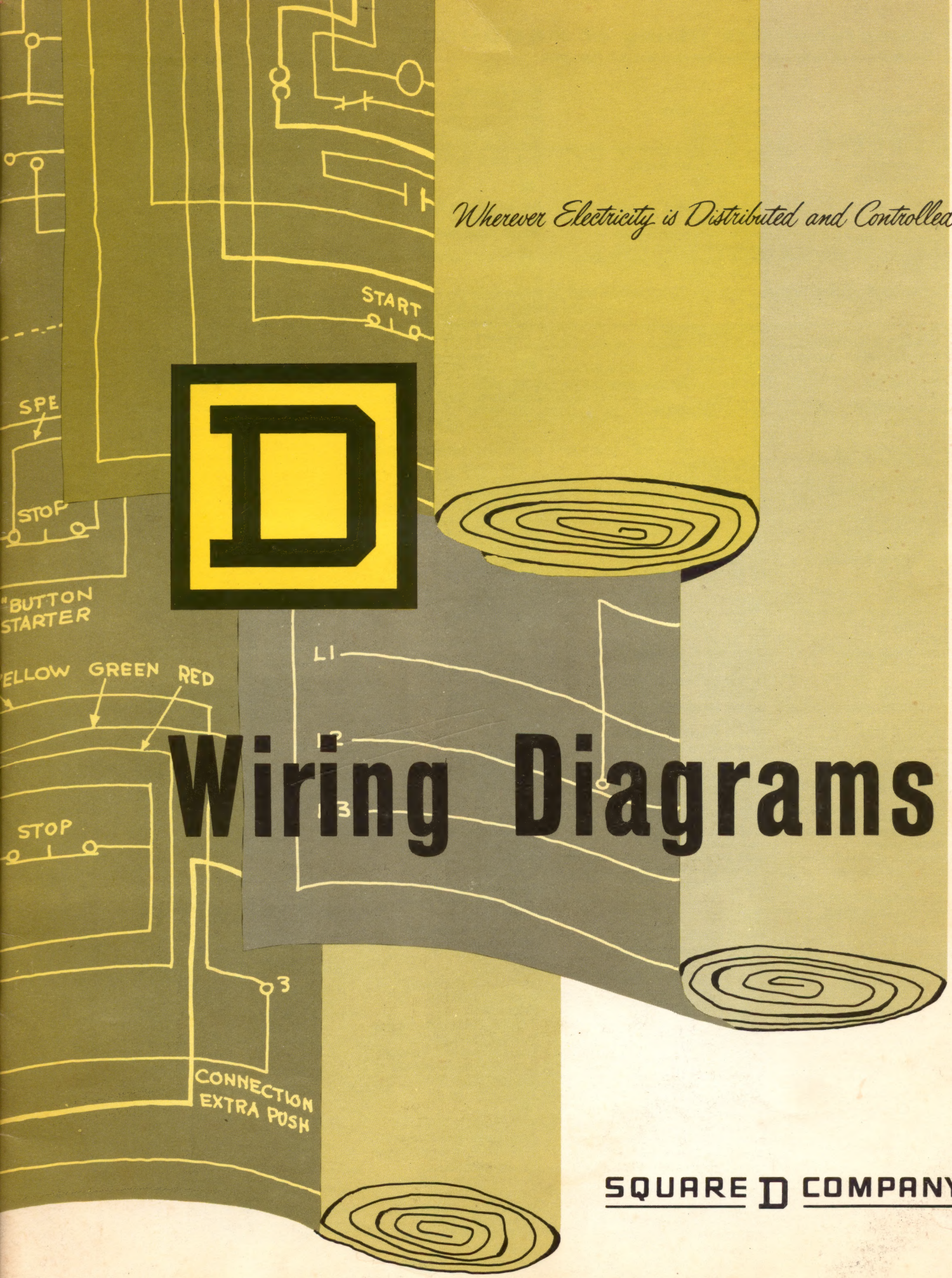


Wherever Electricity is Distributed and Controlled

Wiring Diagrams

SQUARE D COMPANY

comprehensive listing of PRODUCTS

For information on items please contact your local Square D Field Office.

A

AC Magnetic Starters
Adjustable Speed Drives
Alarms, High Water, Pressure
Alternators, Electric
Alternators, Mechanical
Automatic Transfer Panels

B

Bolt-Loc Switches
Brakes, Controlled Torque Electric Foot
Brakes, Magnetic
Busways

C

Cabinets, Fuse
Cabinets, Telephone & Equipment
Circuit Breaker Distribution Panelboards
Circuit Breaker Lighting Panelboards
Circuit Breakers, Enclosed
Circuit Breaker Load Centers, **QO**
Circuit Breakers, Molded Case
Circuit Breakers, Low Voltage Power
Combination **QMB** Motor Starter Panelboards
Combination Service Devices
Combination Starters, Circuit Breaker Type, Switch Type
Combination Starters, Reversing
Compensators, Manual
Contactors, Lighting
Contactors, Magnetic
Contactors, Mechanically Held
Contactors, Welder
Control Centers
Control Circuit Transformers
Control, **Corpak**
Control, Crane
Control, Electric Truck
Control, Irrigation Pumping
Control, Laundry
Control, Marine
Control, Mill Auxiliary
Control, Oil Field Pumping
Control, Punch Press
Control, Resistance Welder
Control, Systems
Control, Synchronous Motor
Controllers, Magnet
Corpak Control Systems
Crane Control, Cab Operated
Crane Control, Floor Operated
Crane Limit Stop
Crane Protective Panels
Crane Safety Disconnect Switch

D

Disconnect Switches
Disconnect Switches, Magnet
Disconnect Switches, Manual Magnetic
Distribution Panelboards, Circuit Breaker
Distribution Panelboards, Fusible
Distribution Unit Substations, Lighting
Drives, Adjustable Speed
Drawout Switchgear
Duct, **I-Line** Feeder
Duct, **I-Line** Plug-In
Duct, Lay-In, Hinged Cover
Duct, Screw Cover
Duct, Service
Duct, Underfloor

E

Electronic Timers
Explosion Proof Enclosures, **Spin Top**
E-Z Stack Multi-Metering Devices

F

Feeder Duct, **I-Line**
Float Switches
Foot Switches
Four Speed Starters
FSP Fusible Load Centers
Fuse Cabinets
Fuse Clips
Fusible Distribution Panelboards
Fusible Lighting Panelboards
Fusible Load Centers, Plug-in
Fusible Service Equipment, Fixed
Fusible Switches

G

Gas Engine Cutouts

H

High Voltage Load Interrupter Switches
High Voltage Starters

I

I-Line Busways
Industrial Circuit Breakers
Industrial Safety Switches
Interlock Kits

J

JIC Troughs
JIC Wireway

L

Laundry Control
Lay-In Duct
Lifting Magnet Controller
Lifting Magnets
Lighting Distribution Unit Substation
Lighting Panelboards, Circuit Breaker
Lighting Panelboards, Fusible
Limit Stop, Crane, **Youngstown**
Limit Switches
Line Voltage Starters
Load Centers, Circuit Breaker
Load Centers, Fusible
Load Center Unit Substations
Load Interrupter Switchgear
Logic Control, **Norpak**
Loom Switches
Low Voltage Power Circuit Breakers
Lugs, Aluminum

M

Magnet Controllers
Magnetic Disconnect Switch
Magnetic Contactors
Magnetic Contactors, Reversing
Magnetic Brakes
Magnetic Overload Relays
Magnetic Relays
Magnetic Starters, AC
Magnetic Starters, DC
Magnetic Starters, Reversing
Magnets, Lifting
Magnets, Road Sweeping
Magnets, Separator
Manual Compensators
Manual Crane Control
Manual Magnetic Disconnect Switch
Manual Reduced Voltage Starters
Manual Speed Regulators
Manual Starters
Marine Control
Master Switches, Mill Duty
Mechanically Held Magnetic Contactors and Relays
Metal-Clad Fusible Switchgear
Metal-Enclosed Drawout Switchgear
Meter Equipment
Mill Auxiliary Control
Mill Switches, Bolt-Loc
Mill Type Master Switches
Motor Field Rheostats
Multi-Speed Starters

N

Non-Synchronous Resistance Welder Control
Norpak Logic Control

O

Oil Field Pumping Control
Oil Immersed Push Button
Oil Immersed Starters
Overload Relays, Magnetic and Thermal

P

Panelboards
Panelboards, Circuit Breaker Distribution
Panelboards, Circuit Breaker Lighting
Panelboards, Combination **QMB** Motor Starter
Panelboards, Fusible Distribution
Panelboards, Fusible Lighting
Panelboards, **I-Line**, Power
Part Winding Motor Starters
Pilot Lights
Plug-In Duct, **I-Line**
Plug-In Limit Switch
Potentiometer, Oil-Tight
Power Service Fittings
Pressure Switches
Primary Resistor Starters
Protective Panels, Crane
Proximity Limit Switch
Pumping Plant Panels
Punch Press Control
Push Buttons and Stations
Push-to-Test Pilot Light

Q

QF Fusible Plug-In Units
QO Circuit Breakers
QO Load Centers

R

Raintight Wireway
Rapac Positioning Systems
Reduced Voltage Starters, Magnetic
Reduced Voltage Starters, Manual
Regulators, Manual Speed
Relays, Magnetic
Relays, Mechanically Held
Relays, Overload
Relays, Timing
Repair Parts
Resistance Welder Control
Resistors, **Tab-Weld**
Resistor Banks
Reversing Combination Starters
Reversing Drum Switches
Reversing Magnetic Contactors
Reversing Magnetic Starters
Rheostats, Motor Field

S

Safety Switches, Heavy Duty
Safety Switches, General Duty
Safety Switches, Double-Throw
Selector Switches
Service Entrance Equipment, Circuit Breaker
Service Entrance Equipment, Combination Type
Service Entrance Equipment, Fusible
Service Entrance Equipment, High Voltage 5 and 15 KV
Service Fittings, Underfloor
Servicepak Panel
Snap Switches
Sockets, Meter
Speed Regulators, Manual
Spin Top Enclosures
Square-Duct
Starters, AC
Starters, Auto-Transformer Type
Starters, Combination
Starters, DC
Starters, Four Speed
Starters, High Voltage
Starters, Line Voltage
Starters, Magnetic
Starters, Manual
Starters, Multi-Speed
Starters, Oil-Immersed
Starters, Part Winding
Starters, Primary Resistor
Starters, Reduced Voltage
Starters, Star-Delta
Starters, Synchronous Motors
Starters, Three Speed
Starters, Two Speed
Stata Crane Control
Static Control
Steel Mill Control
Substations, Unit **Power-Zone**
Sump Control, **Sumptrol**
Switchboards, **Power-Style**
Switches, Bolt-Loc
Switches, 5 and 15 KV
Switches, Float
Switches, Foot
Switches, Limit
Switches, Loom
Switches, Pressure
Switches, Reversing Drum
Switches, Safety
Switches, Snap
Switches, Temperature
Switches, Vacuum
Switchgear, Metal-Clad
Switchgear, Metal-Enclosed
Synchronous Motor Control
Synchronous Resistance Welder Control

T

Tab-Weld Resistors
Telephone Cabinets
Telephone Service Fittings
Temperature Switches
Terminal Blocks
Thermal Overload Relays
Three Speed Starters
Timers
Transfer Panels, Automatic
Transformer, Control Circuit
Transformers, Unit Substations
Trough, JIC
Trough, Meter
Truck Control, Electric
Two Speed Starters

U

Underfloor Duct
Unit Substations
Unloaders, Magnetic

V

Vacuum Switches
Valves, Solenoid
Voltage Testers

W

Well-Guard Control
Welder Control, Resistance
Wireway, JIC
Wireway, **Square-Duct**
Wireway, Raintight
Wye-Delta Starters

Y

Youngstown Limit Stop

Printed in U. S. A.

TABLE OF CONTENTS

TERMINOLOGY

Wiring Diagram—Shows actual physical layout of components and wiring. Used for wiring up systems or tracing wires when trouble shooting.

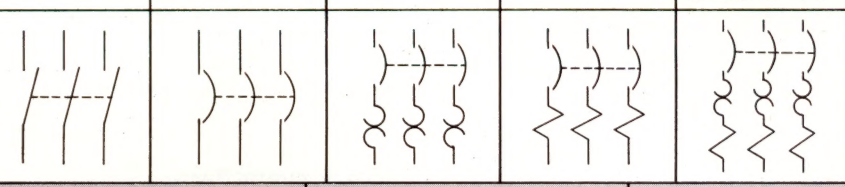
Elementary Diagram—Lines are drawn as directly as possible to show operation of circuit in simplest manner. Does not show physical layout. Also called Line Diagram and Schematic Diagram.

STANDARD ELEMENTARY DIAGRAM SYMBOLS

The diagram symbols shown below have been adopted by the Square D Company from standards established by the National Electrical Manufacturers Association (NEMA). Where no NEMA standard exists, an American Standards Association (ASA) standard is used and is so marked.

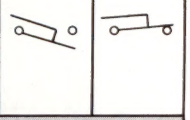
SWITCHES

DISCONNECT | CIRCUIT INTERRUPTER | CIRCUIT BREAKER W/THERMAL O.L. | CIRCUIT BREAKER W/MAGNETIC O.L. | CIRCUIT BREAKER W/THERMAL AND MAGNETIC O.L.



LIMIT SWITCHES: NORMALLY OPEN | NORMALLY CLOSED | HELD CLOSED | HELD OPEN

FOOT SWITCHES: N.O. | N.C.

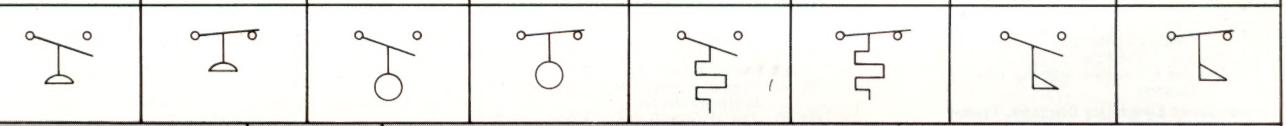


PRESSURE & VACUUM SWITCHES: N.O. | N.C.

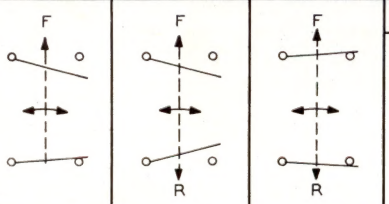
LIQUID LEVEL SWITCH: N.O. | N.C.

TEMPERATURE ACTUATED SWITCH: N.O. | N.C.

FLOW SWITCH (AIR, WATER, ETC.): N.O. | N.C.



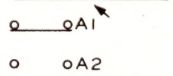
SPEED (PLUGGING) | ANTI-PLUG



SELECTOR

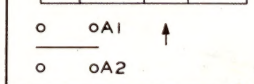
2 POSITION

A1	X	
A2		X
	LOW	HIGH



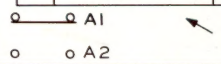
3 POSITION

A1	X		
A2			X
	HAND	OFF	AUTO



2 POS. SEL. PUSH BUTTON

A1	X			
A2		X	X	X
	FREE	DEPRES'D	FREE	DEPRES'D
	JOG		RUN	



PUSH BUTTONS

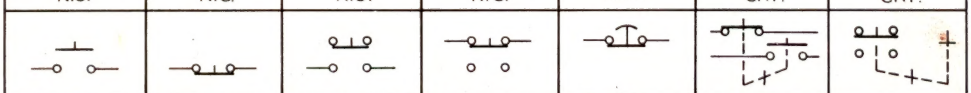
MOMENTARY CONTACT

SINGLE CIRCUIT: N.O. | N.C.

DOUBLE CIRCUIT: N.O. | N.C.

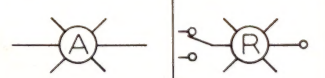
MUSHROOM HEAD

MAINTAINED CONTACT: TWO SINGLE CKT. | ONE DOUBLE CKT.



PILOT LIGHTS

INDICATE COLOR BY LETTER: NON PUSH-TO-TEST | PUSH-TO-TEST



CONTACTS

INSTANT OPERATING

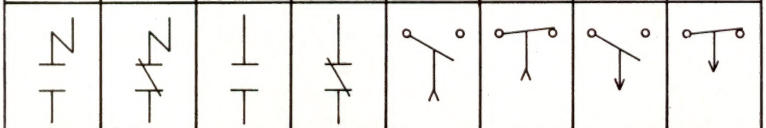
WITH BLOWOUT: N.O. | N.C.

WITHOUT BLOWOUT: N.O. | N.C.

TIMED CONTACTS - CONTACT ACTION RETARDED AFTER COIL IS:

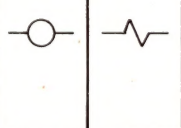
ENERGIZED: N.O.T.C. | N.C.T.O.

DE-ENERGIZED: N.O.T.O. | N.C.T.C.



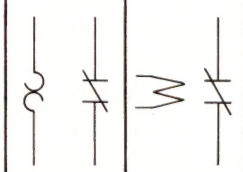
COILS

SHUNT | SERIES



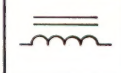
OVERLOAD RELAYS

THERMAL | MAGNETIC

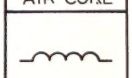


INDUCTORS

IRON CORE



AIR CORE

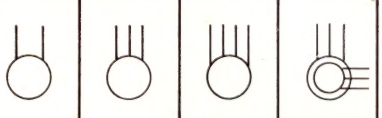


TRANSFORMERS

AUTO | IRON CORE | AIR CORE | CURRENT | DUAL VOLTAGE

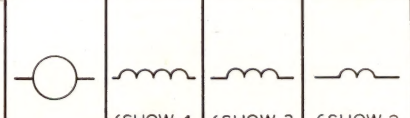
AC MOTORS

SINGLE PHASE | 3 PHASE SQUIRREL CAGE | 2 PHASE 4 WIRE | WOUND ROTOR

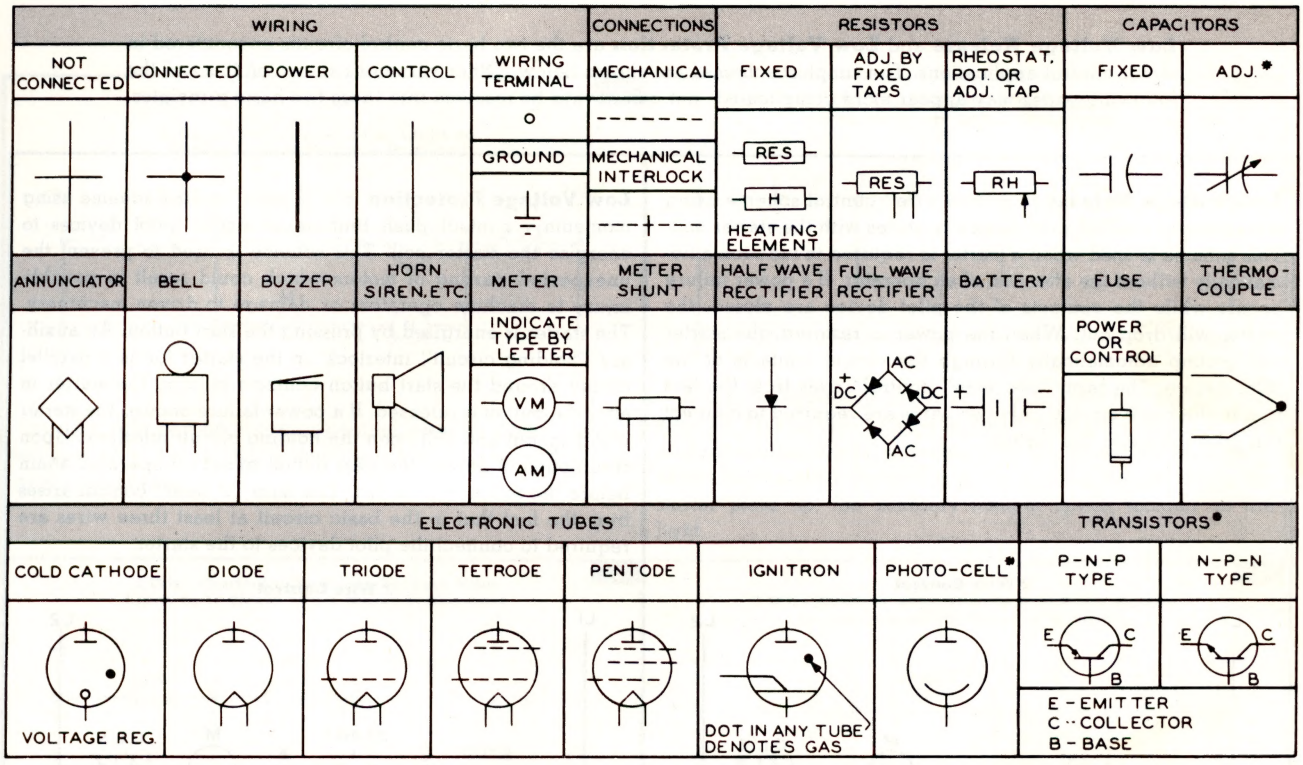


DC MOTORS

ARMATURE | SHUNT FIELD | SERIES FIELD | COMM. OR COMPENS. FIELD



STANDARD ELEMENTARY DIAGRAM SYMBOLS



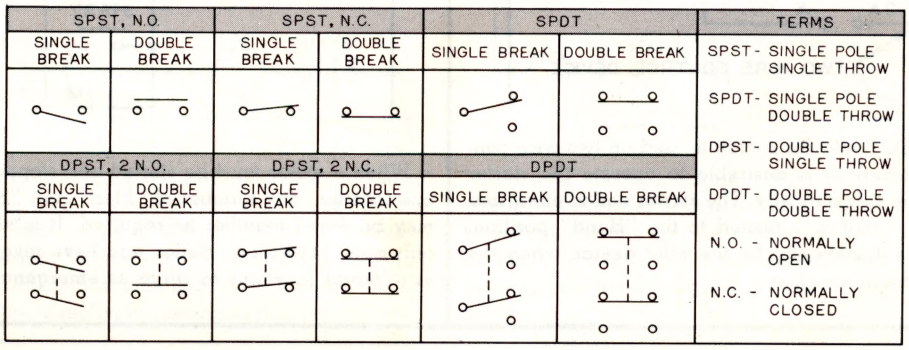
* A S A SYMBOL.

CONTROL AND POWER CONNECTIONS — 600 VOLTS OR LESS — ACROSS-THE-LINE STARTERS

(From NEMA Standard IC-1-21A.60)

		1 PHASE	2 PHASE 4 WIRE	3 PHASE
LINE MARKINGS		L1, L2	L1, L3 - PHASE 1 L2, L4 - PHASE 2	L1, L2, L3
GROUND WHEN USED		L1 IS ALWAYS UNGROUNDED	—	L2
MOTOR RUNNING OVERCURRENT UNITS IN	1 ELEMENT	L1	—	—
	2 ELEMENT	—	L1, L4	L1, L3
	3 ELEMENT	—	—	L1, L2, L3
CONTROL CIRCUIT CONNECTED TO		L1, L2	L1, L3	L1, L2
FOR REVERSING INTERCHANGE LINES		—	L1, L3	L1, L3

SUPPLEMENTARY CONTACT SYMBOLS

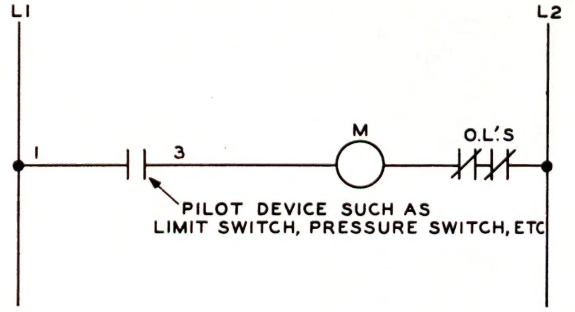


TYPICAL CONTROL CIRCUIT ELEMENTARY DIAGRAMS

Low Voltage Release and **Low Voltage Protection** are the two basic control circuits encountered in motor control applications. The simplest schemes are shown below. Other variations shown on this and the following pages may appear more complicated, but can always be resolved into these two basic principles.

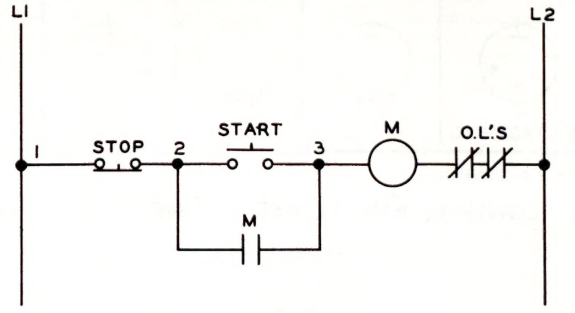
Low Voltage Release is a "two wire" control scheme using a maintained contact pilot device in series with the starter coil. This scheme is used when a starter is required to function automatically without the attention of an operator. If a power failure occurs while the contacts of the pilot device are closed, the starter will drop out. When the power is restored, the starter will pickup automatically through the closed contacts of the pilot device. The term "two wire" control arises from the fact that in the basic circuit, only two wires are required to connect the pilot device to the starter.

2 Wire Control



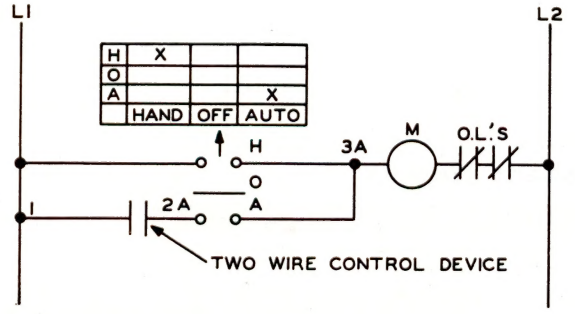
Low Voltage Protection is a "3 wire" control scheme using momentary contact push buttons or similar pilot devices to energize the starter coil. This scheme is used to prevent the unexpected starting of motors which could result in possible injury to machine operators or damage to driven machinery. The starter is energized by pressing the start button. An auxiliary "holding circuit" interlock on the starter forms a parallel circuit around the start button contacts holding the starter in after the button is released. If a power failure occurs, the starter will drop out and will open the holding circuit interlock. Upon resumption of power, the start button **must** be operated again before the motor will restart. The term "3 wire" control arises from the fact that in the basic circuit at least three wires are required to connect the pilot devices to the starter.

3 Wire Control



1

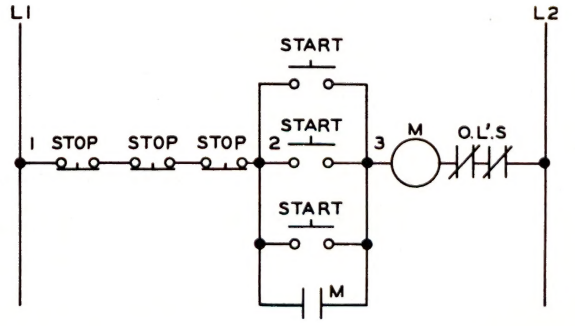
2 Wire Control — With Maintained Contact Hand-Off-Auto Selector Switch



A "Hand-Off-Auto" selector switch is used on two wire control applications where it is desirable to operate the starter manually as well as automatically. The starter coil is energized manually when the switch is turned to the "Hand" position, and is energized automatically by the pilot device when the switch is in the "Auto" position.

2

3 Wire Control — Momentary Contact Multiple Push Button Station

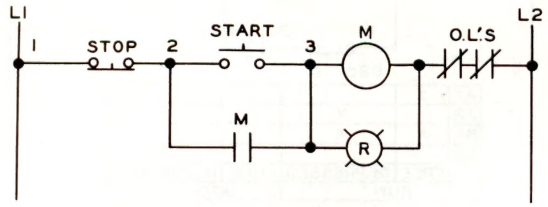


When a motor must be started and stopped from more than one location, any number of "Start" and "Stop" push buttons may be wired together as required. It is also possible to use only one "Start-Stop" station and have several "Stop" buttons at different locations to serve as emergency stop.

TYPICAL CONTROL CIRCUIT ELEMENTARY DIAGRAMS

3

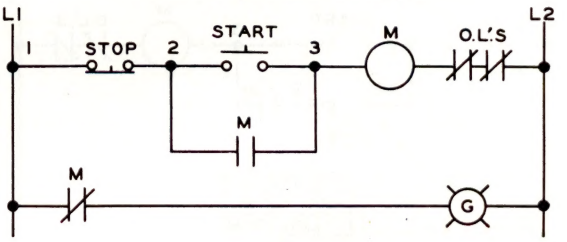
3 Wire Control with Pilot Light to Indicate when Motor is Running



A pilot light can be wired in parallel with the starter coil to indicate when the starter is energized and thus show that the motor is running.

4

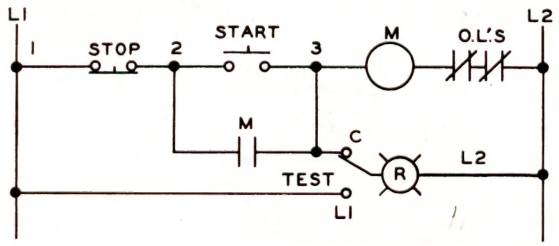
3 Wire Control with Pilot Light to Indicate when Motor is Stopped



A pilot light may be required to indicate when the motor is stopped. This can be done by wiring a normally closed auxiliary contact on the starter in series with the pilot light as shown. When the starter is deenergized, the pilot light is on. When the starter picks up, the auxiliary contact opens, turning off the light.

5

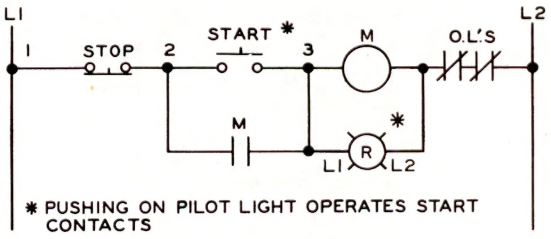
3 Wire Control with Push-To-Test Pilot Light to Indicate when Motor is Running



When the motor running pilot light is not lit, there may be doubt as to whether the circuit is open or whether the pilot light bulb is burned out. The push-to-test pilot light enables the testing of the bulb simply by pushing on the color cap.

6

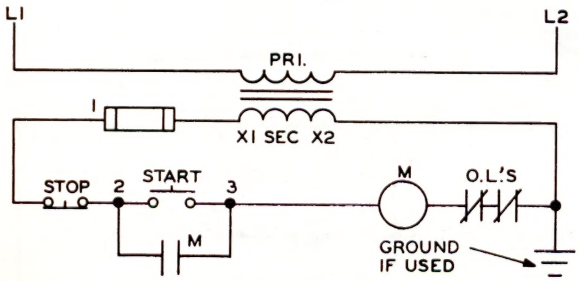
3 Wire Control with Illuminated Push Button to Indicate when Motor is Running



The illuminated push button combines a start button and a pilot light in one unit. Pressing the pilot light lens operates the start contacts. Space is saved by requiring only a two unit push button station instead of three.

7

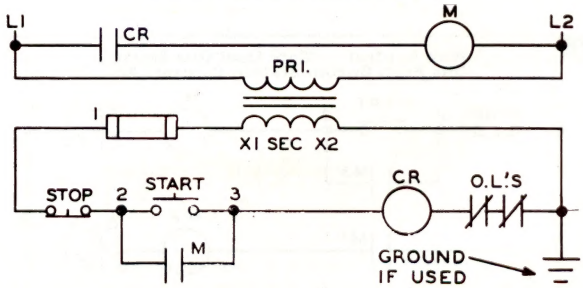
3 Wire Control with Fused Control Circuit Transformer



A step down transformer can be used to provide a control circuit voltage lower than line voltage for reasons of operator safety. One side of the transformer secondary can be grounded when conditions permit. Short circuit protection for the transformer and control circuit is provided by a fuse in the ungrounded side of the transformer secondary.

8

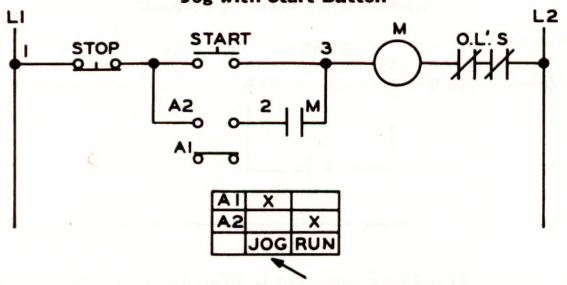
3 Wire Control with Fused Control Circuit Transformer and Control Relay



A starter coil with a high volt-ampere rating may require a control transformer of considerable size. A control relay and a transformer with a low VA rating can be connected so that the normally open relay contact controls the starter coil on the primary or line side. Square D Size 5 Form FT starters use this scheme.

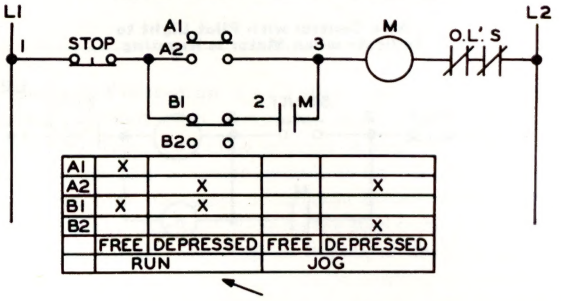
TYPICAL CONTROL CIRCUIT ELEMENTARY DIAGRAMS

9 **Jogging Using a Selector Switch — Jog with Start Button**



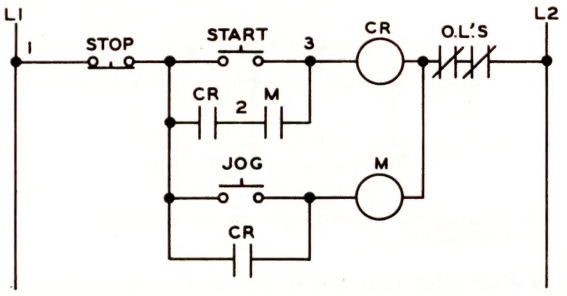
Jogging, or inching, is defined by NEMA as the momentary operation of a motor from rest for the purpose of accomplishing small movements of the driven machine. One method of jogging is shown above. The selector switch disconnects the holding circuit interlock and jogging may be accomplished by pressing the "Start" button.

10 **Jogging Using a Selector Push Button**



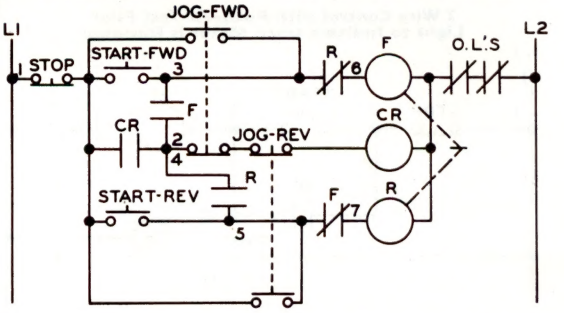
The use of a selector push button to obtain jogging is shown above. In the "Run" position the selector-push button gives normal 3 wire control. In the "Jog" position, the holding circuit is broken and jogging is accomplished by depressing the button.

11 **Jogging Using a Control Relay**



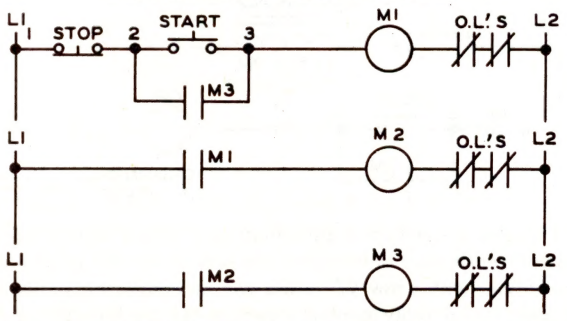
Pressing the "Start" button energizes the control relay which in turn energizes the starter coil. The normally open starter interlock and relay contact then form a holding circuit around the "Start" button. Pressing the "Jog" button energizes the starter coil independent of the relay and no holding circuit forms, thus jogging can be obtained.

12 **Jogging Using a Control Relay for Reversing Starter**



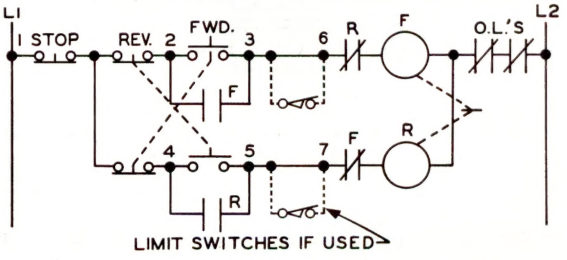
This control scheme permits jogging the motor either in the forward or reverse direction whether the motor is at standstill or is rotating in either direction. Pressing the "Start-Forward" or "Start-Reverse" buttons energizes the corresponding starter coil which closes the circuit to the control relay. The relay picks up and completes the holding circuit around the "Start" button. As long as the relay is energized either the forward or reverse contactor will remain energized. Pressing either "Jog" button will deenergize the relay releasing the closed contactor. Further pressing of the "Jog" button permits jogging in the desired direction.

13 **3 Wire Control — More than One Starter, One Push Button Station Controls All**



When one "Start-Stop" station is required to control more than one starter, the scheme above can be used. A maintained overload on any one of the motors will drop out all three starters.

14 **• 3 Wire Control — Reversing Starter**



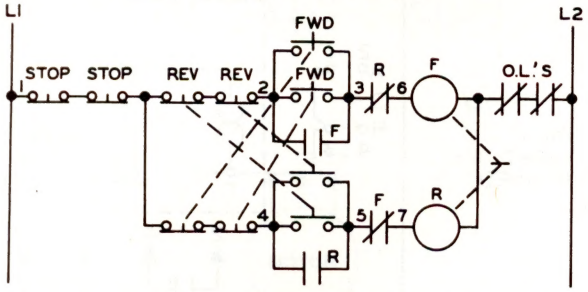
3 wire control of a reversing starter can be accomplished with a "Forward-Reverse-Stop" push button station as shown above. Limit switches can be added to stop the motor at a certain point in either direction. Jumpers 6 to 3 and 7 to 5 must then be removed.

• Revised — 12/67

TYPICAL CONTROL CIRCUIT ELEMENTARY DIAGRAMS

15

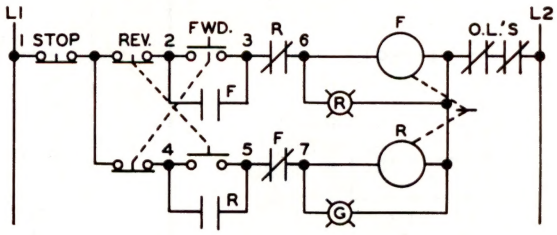
3 Wire Control — Reversing Starter Multiple Push Button Station



More than one "Forward-Reverse-Stop" push button station may be required and can be connected in the manner shown above.

16

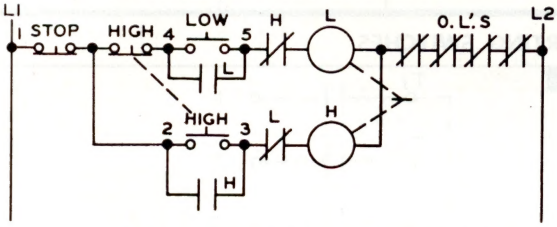
3 Wire Control — Reversing Starter with Pilot Lights to Indicate Direction Motor is Running



Pilot lights can be connected in parallel with the forward and reverse contactor coils to indicate which contactor is energized and thus which direction the motor is running.

17

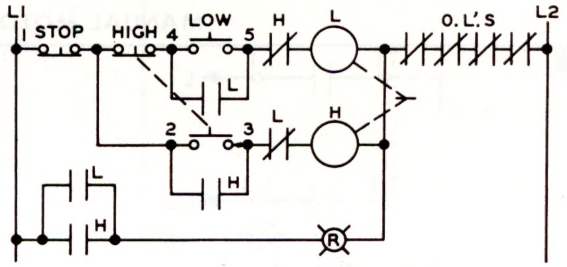
3 Wire Control — Two Speed Starter



3 wire control of a two speed starter with a "High-Low-Stop" push button station is shown above. This scheme allows the operator to start the motor from rest at either speed or to change from low to high speed. The "Stop" button must be operated before it is possible to change from high to low speed. This arrangement is intended to prevent excessive line current and shock to motor and driven machinery which results when motors running at high speed are reconnected for a lower speed.

18

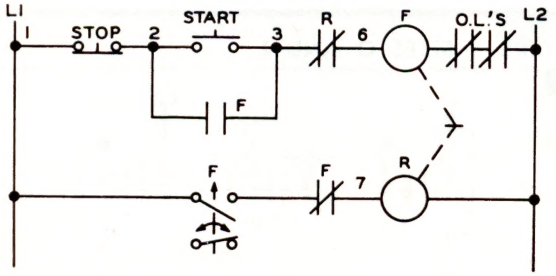
3 Wire Control — Two Speed Starter with One Pilot Light to Indicate Motor Operation at Each Speed



One pilot light can be used to indicate operation at both low and high speeds. One extra normally open interlock on each contactor is required. Two pilot lights, one for each speed, could be used by connecting pilot lights in parallel with high and low coils. (See Reversing Starter diagram above).

19

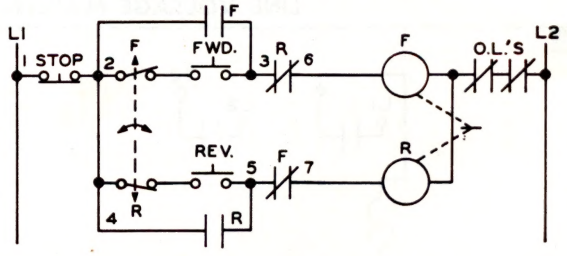
Plugging a Motor to a Stop from One Direction Only



Plugging is defined by NEMA as a system of braking in which the motor connections are reversed so that the motor develops a counter-torque, thus exerting a retarding force. In the above scheme, the forward rotation of the motor closes the normally open plugging switch contact. When the "Stop" button is operated, the forward contactor drops out, energizing the reverse contactor through the plugging switch and normally closed forward interlock. This reverses motor connections and the motor is braked to a stop. The plugging switch then opens and disconnects the reverse contactor which is used only for plug-stopping and not for running in reverse.

20

Anti-Plugging — Motor to be Reversed but Must Not be Plugged

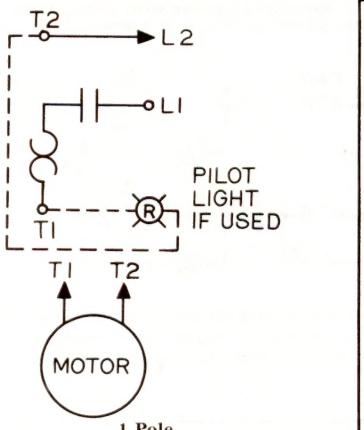


Anti-plugging protection is defined by NEMA as the effect of a device which operates to prevent application of counter-torque by the motor until the motor speed has been reduced to an acceptable value. In the scheme above, with the motor operating in one direction, a contact on the anti-plugging switch opens the control circuit of the contactor used for the opposite direction. This contact will not close until the motor has slowed down, after which the other contactor can be energized.

CLASS 2510
AC MANUAL STARTERS AND MANUAL MOTOR STARTING SWITCHES

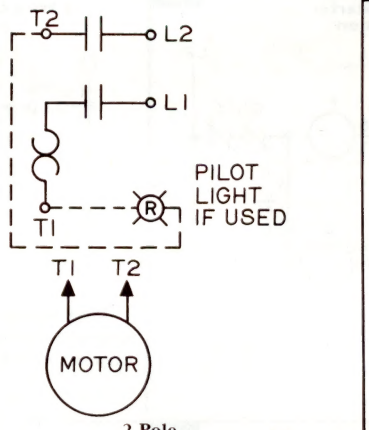
FRACTIONAL HORSEPOWER MANUAL STARTERS — TYPE F

21



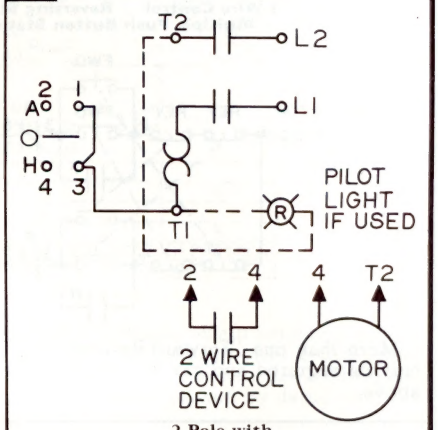
1 Pole

22



2 Pole

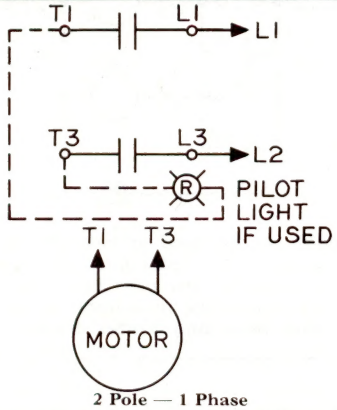
23



2 Pole with Selector Switch

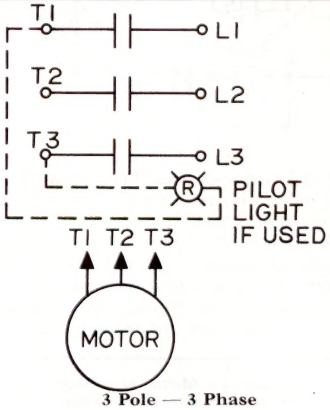
MANUAL MOTOR STARTING SWITCHES

24



2 Pole — 1 Phase

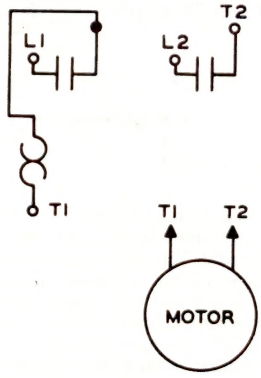
25



3 Pole — 3 Phase

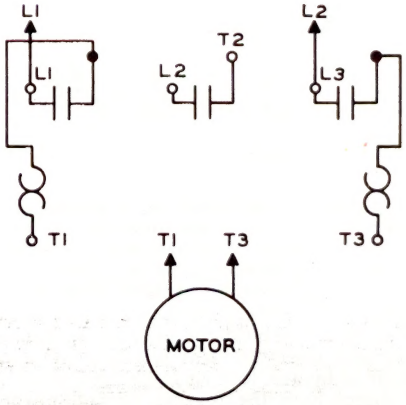
LINE VOLTAGE MANUAL STARTERS — SIZES 0 AND 1

26



2 Pole — 1 Phase

27

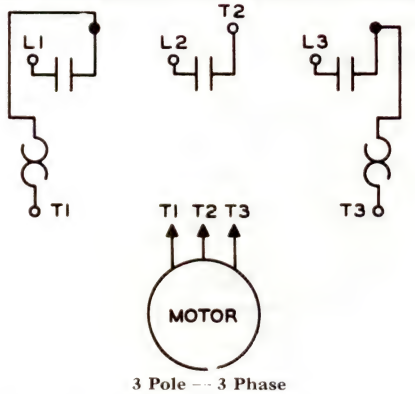


3 Pole — 1 Phase

CLASS 2510
AC MANUAL STARTERS

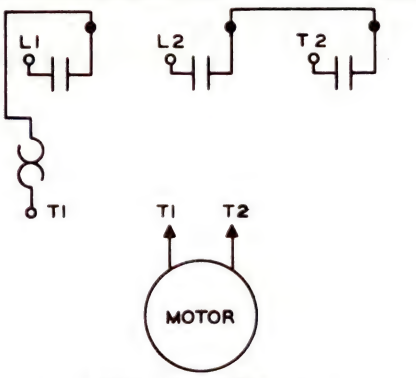
LINE VOLTAGE MANUAL STARTERS — SIZES 0 AND 1

28



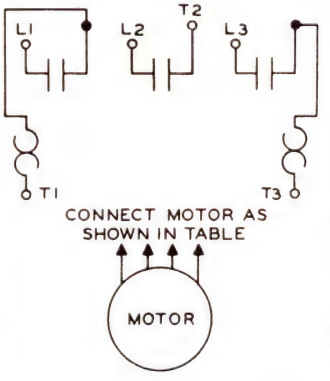
3 Pole — 3 Phase

29



3 Pole — Direct Current

30

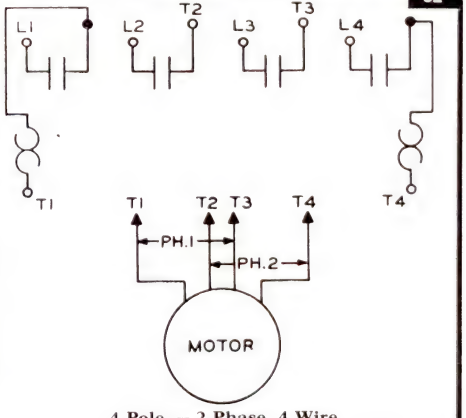


	LINE CONNECTIONS				LOAD CONNECTIONS			
STARTER MARKINGS	L1	L2	L3	—	T1	T2	T3	—
FOR 2 Ø,3 WIRE	L1	L2	L3	—	T1	T4 T3	T2	—
FOR 2 Ø,4 WIRE	L1	L3	L2	L4 TO T4	T1	T3	T2	T4 TO L4

FOR 2 PHASE CONNECTIONS USING THREE POLE STARTER, CONNECT LINE AND MOTOR TERMINALS TO THE STARTER TERMINAL IN THE SAME COLUMN.

3 Pole — 2 Phase, 3 and 4 Wire

31

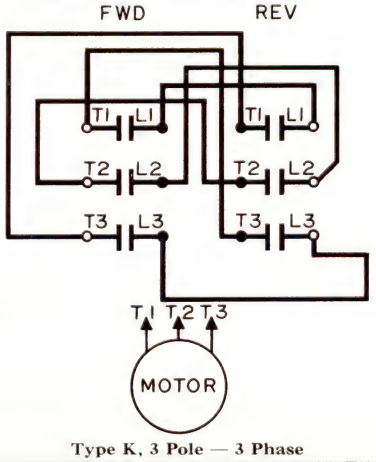


4 Pole — 2 Phase, 4 Wire

CLASS 2511
AC REVERSING MANUAL STARTERS AND MANUAL MOTOR STARTING SWITCHES

32

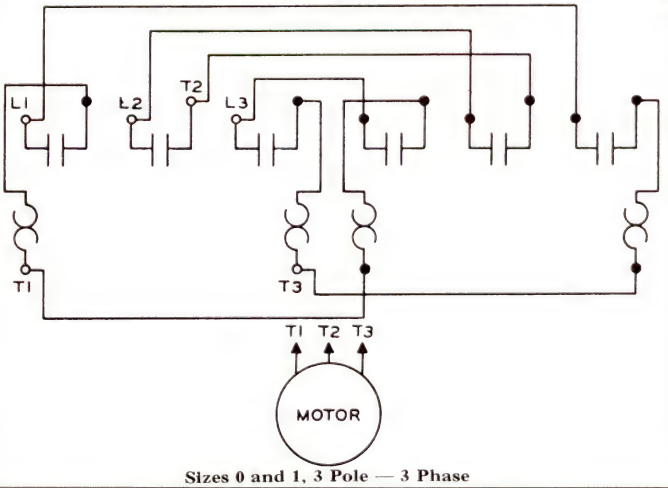
REVERSING MANUAL MOTOR STARTING SWITCH



Type K, 3 Pole — 3 Phase

33

REVERSING MANUAL STARTER

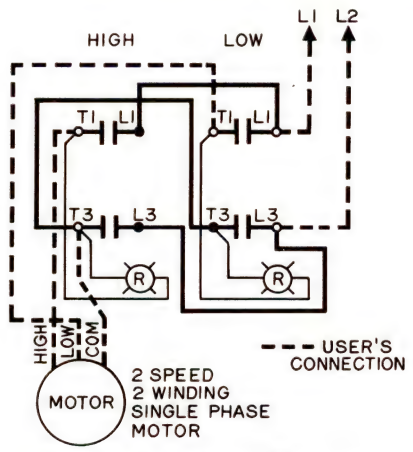


Sizes 0 and 1, 3 Pole — 3 Phase

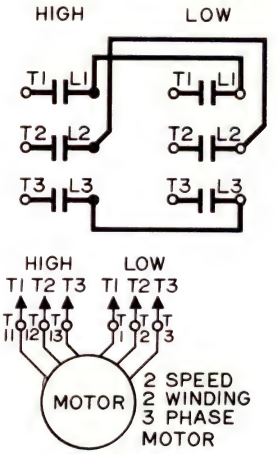
CLASS 2512
AC TWO SPEED MANUAL STARTERS AND MANUAL STARTING SWITCHES

34

TWO SPEED MANUAL MOTOR STARTING SWITCH — TYPE K



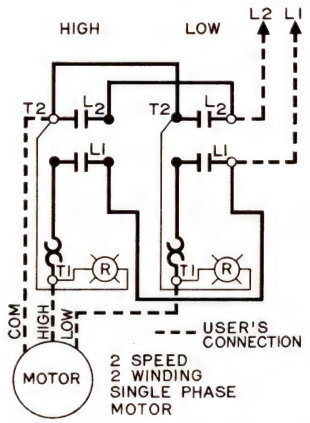
2 Pole, Single Phase with Pilot Lights



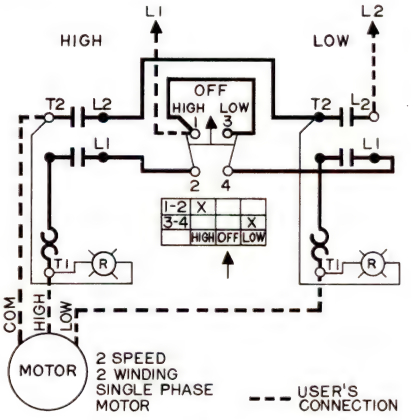
3 Pole, 3 Phase

35

TWO SPEED MANUAL MOTOR STARTERS — TYPE F



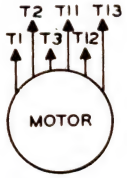
2 Unit — 2 Pole with
Mechanical Interlock and Pilot Lights

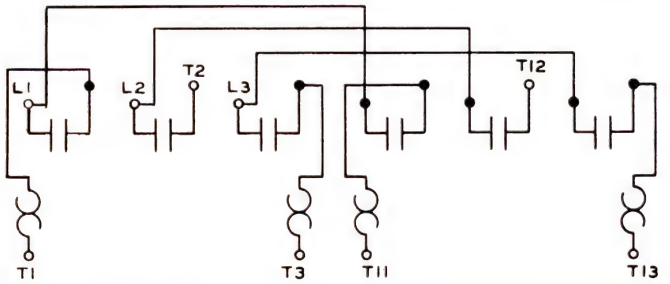


3 Unit — 2 Pole with
Selector Switch and Pilot Lights

36

SIZES 0 AND 1 — TWO SPEED MANUAL STARTERS





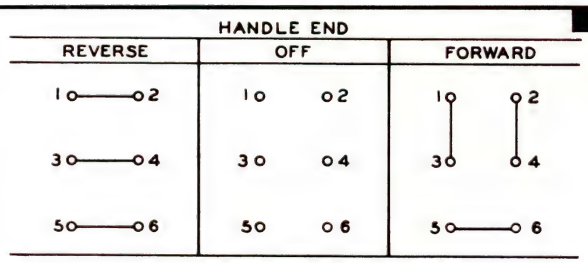
Two Speed Starter
For Wye Connected
Separate Winding Motor

WIRING DIAGRAMS

CLASS 2601
DRUM SWITCHES

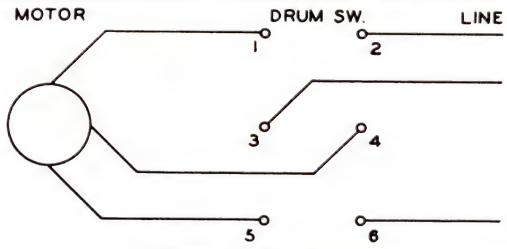
SIZES 0 & 1

37



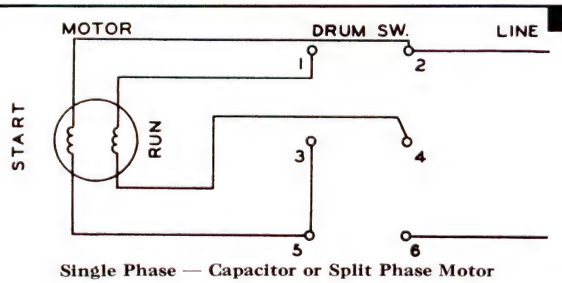
Internal Switching

38



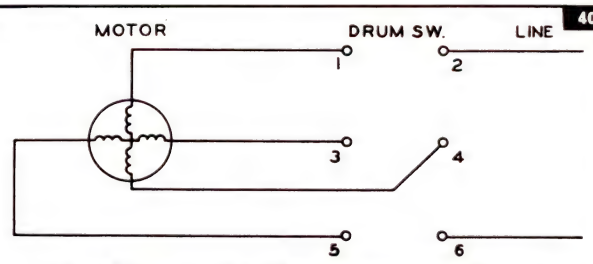
3 Phase — 3 Wire Motor

39



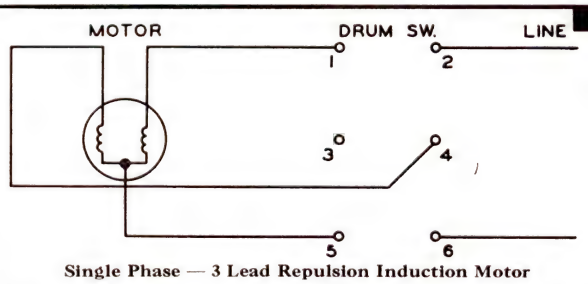
Single Phase — Capacitor or Split Phase Motor

40



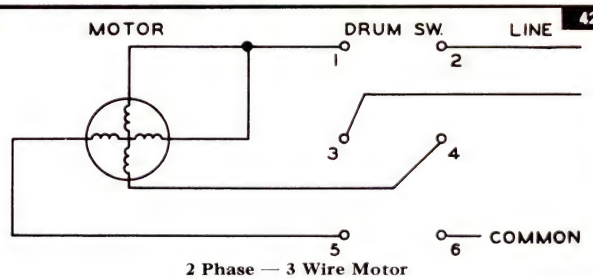
Single Phase — 4 Lead Repulsion Induction Motor

41



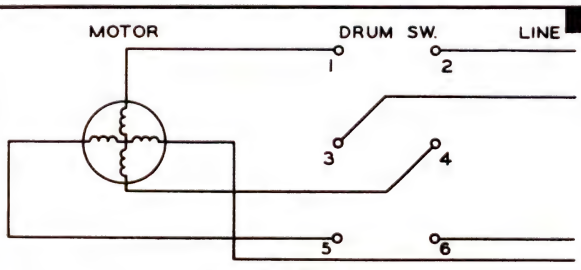
Single Phase — 3 Lead Repulsion Induction Motor

42



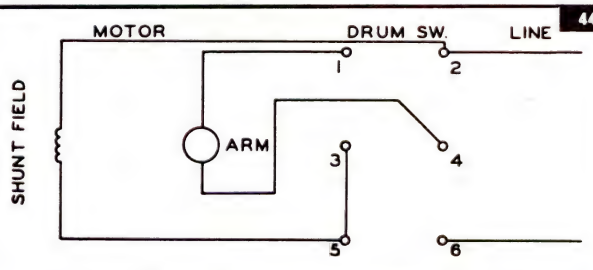
2 Phase — 3 Wire Motor

43



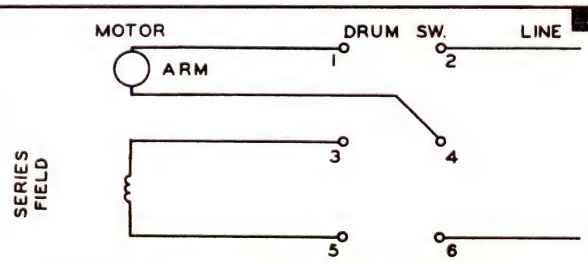
2 Phase — 4 Wire Motor

44



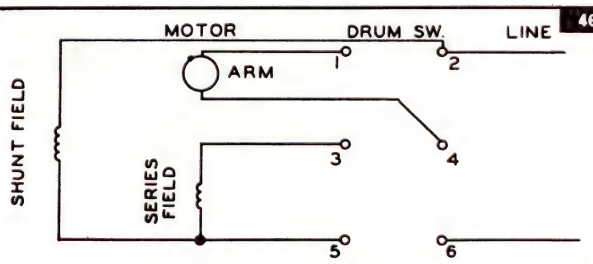
Direct Current — Shunt Motor

45



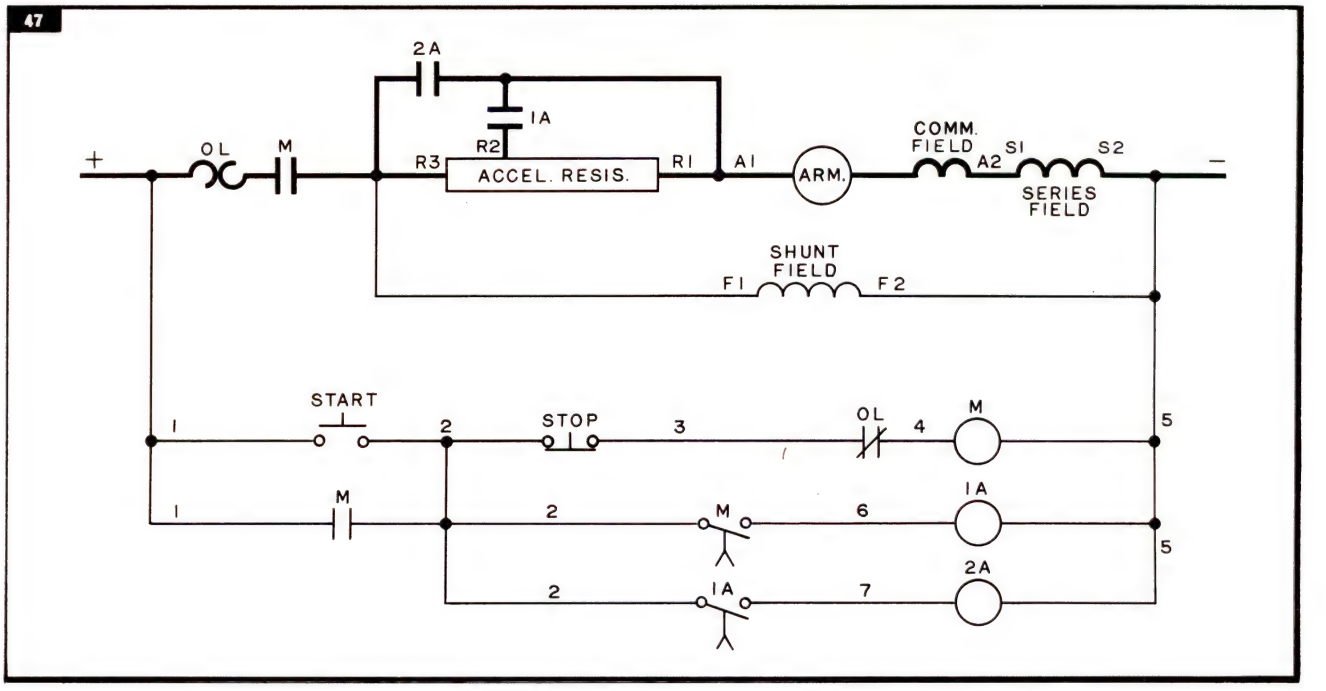
Direct Current — Series Motor

46

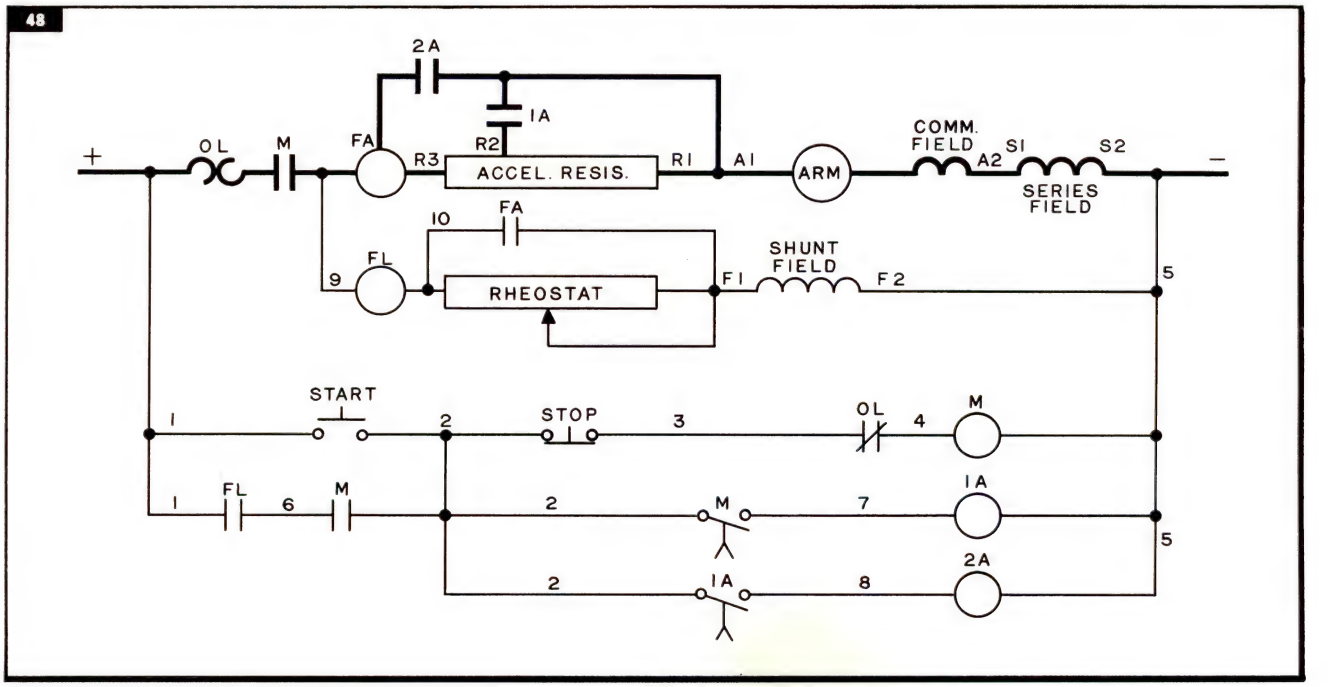


Direct Current — Compound Motor

CLASS 7135
CONSTANT SPEED, DC STARTER

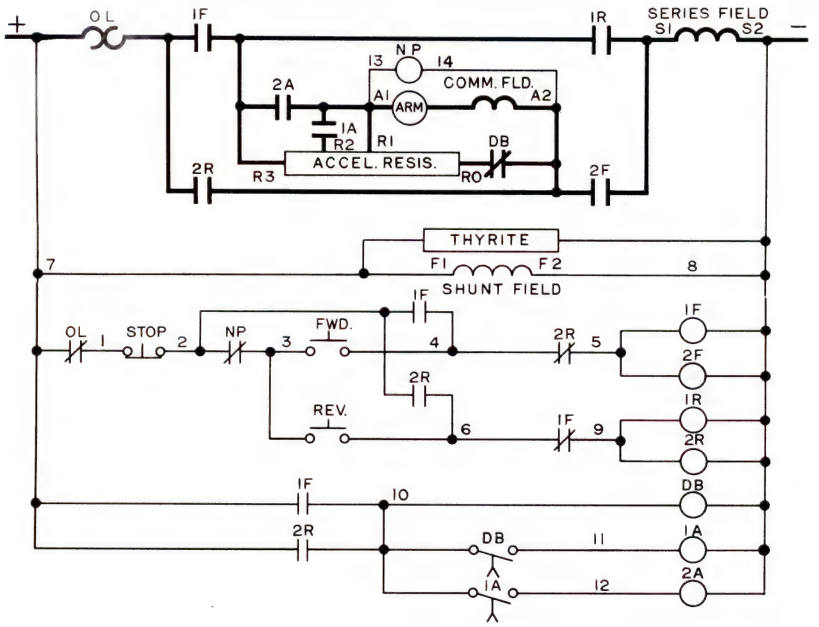


CLASS 7136
ADJUSTABLE SPEED, DC STARTER



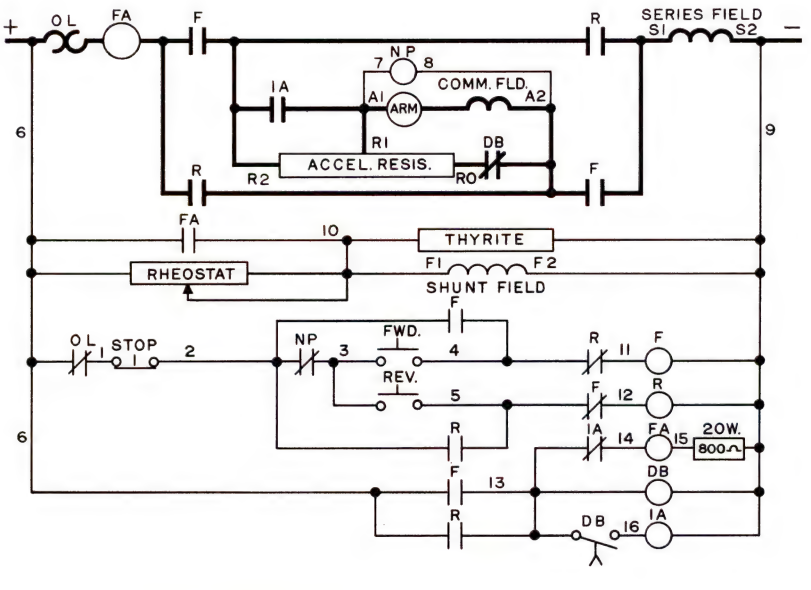
CLASS 7735
REVERSING CONSTANT SPEED, DC STARTER

49



CLASS 7736
REVERSING ADJUSTABLE SPEED, DC STARTER

50



CLASSES 8501, 8508
AC MAGNETIC RELAYS

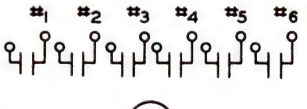
51 TYPE A, 10 AMPERE RELAY, CONVERTIBLE CONTACTS

Contact Arrangement

2, 3 and 4 Pole

No. of Poles	Type No.	Contact Number 1	2	3	4
2	AO-20	O			O
	AO-11	O			X
	AO-02	X			X
3	AO-30	O	O		O
	AO-21	O	O		X
	AO-12	O	X		X
	AO-03	X	X		X
4	AO-40	O	O	O	O
	AO-31	O	O	O	X
	AO-22	O	O	X	X
	AO-13	O	X	X	X
	AO-04	X	X	X	X

Contact Arrangement



6 Pole

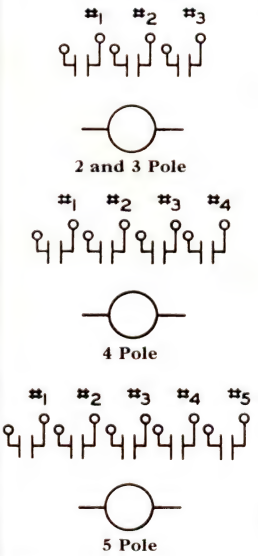
O—Normally Open Contact
X—Normally Closed Contact

No. of Poles	Type No.	Contact Number 1	2	3	4	5	6
6	AO-60	O	O	O	O	O	O
	AO-51	O	O	O	O	O	X
	AO-42	O	O	O	O	X	X
	AO-33	O	O	O	X	X	X
	AO-24	O	O	X	X	X	X
	AO-15	O	X	X	X	X	X
	AO-06	X	X	X	X	X	X

Note: Class 8508 Type A mechanically held relays have same contact arrangements as above except unlatch coil is added to diagram.

52 TYPE B, 15 AMPERE RELAY, CONVERTIBLE CONTACTS

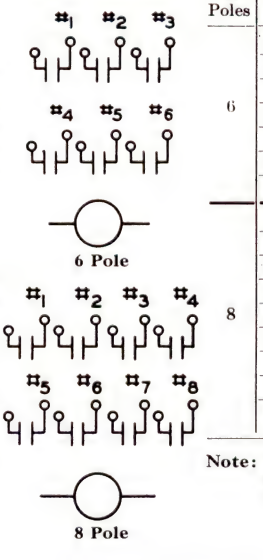
Contact Arrangement



No. of Poles	Type Number	Contact Number 1	2	3	4	5
2	BHO-20	O		O		
	BHO-11	O		X		
	BHO-02	X		X		
3	BHO-30	O	O	O		
	BHO-21	O	O	X		
	BHO-12	O	X	X		
	BHO-03	X	X	X		
4	BHO-40	O	O	O	O	
	BHO-31	O	O	O	X	
	BHO-22	O	O	X	X	
	BHO-13	O	X	X	X	
	BHO-04	X	X	X	X	
5	BHO-50	O	O	O	O	O
	BHO-41	O	O	O	O	X
	BHO-32	O	O	O	X	X
	BHO-23	O	O	X	X	X
	BHO-14	O	X	X	X	X
	BHO-05	X	X	X	X	X

O—Normally Open Contact
X—Normally Closed Contact

Contact Arrangement

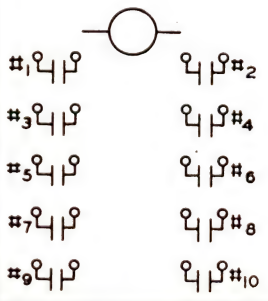


No. of Poles	Type Number	Contact Number 1	2	3	4	5	6	7	8
6	BHO-60	O	O	O	O	O	O		
	BHO-51	O	O	X	O	O	O		
	BHO-42	O	X	X	O	O	O		
	BHO-33	X	X	X	O	O	O		
	BHO-24	X	X	X	O	O	X		
	BHO-15	X	X	X	O	X	X		
	BHO-06	X	X	X	X	X	X		
8	BHO-80	O	O	O	O	O	O	O	O
	BHO-71	O	O	O	X	O	O	O	O
	BHO-62	O	O	X	X	O	O	O	O
	BHO-53	O	X	X	X	O	O	O	O
	BHO-44	X	X	X	X	O	O	O	O
	BHO-35	X	X	X	X	O	O	O	X
	BHO-26	X	X	X	X	O	O	X	X
	BHO-17	X	X	X	X	O	X	X	X
	BHO-08	X	X	X	X	X	X	X	X

Note: Class 8508 Type B mechanically held relays have same contact arrangements as above except unlatch coil is added to diagram.

53 TYPE D, 10 AMPERE RELAY, FIXED CONTACTS

Contact Arrangement



Type No.	Contact Number 1	2	3	4	5	6	7	8	9	10
DO-20	O	O								
DO-02			X	X						
DO-22	∗O	∗O	∗X	∗X						
DO-40	O	O	O	O						
DO-42	O	O	∗O	∗O	∗X	∗X				
DO-44	O	O	O	O			X	X	X	X
DO-60	O	O			O	O			O	O
DO-62	O	O	O	O	O	O			X	X
DO-64	O	O	O	O	∗O	∗O	∗X	∗X	X	X
DO-80	O	O	O	O	O	O			O	O
DO-82	O	O	O	O	∗O	∗O	∗X	∗X	O	O

Note: Class 8508 Type D mechanically held relays have same contact arrangements as shown at left except unlatch coil is added to diagram.

O—Normally Open Contact

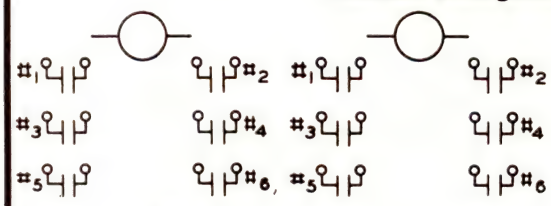
X—Normally Closed Contact

∗—Contacts of Individual Double Throw Poles must be used on the same polarity.

TYPE D RELAY OPERATED TIMER, FIXED CONTACTS

54

Contact Arrangement



Type Number	Contact Number					
	1	2	3	4	5	6
DDO-22 DEO-22	*O	*O	*X	*X		
DDO-42 DEO-42	O	O	*O	*O	*X	*X

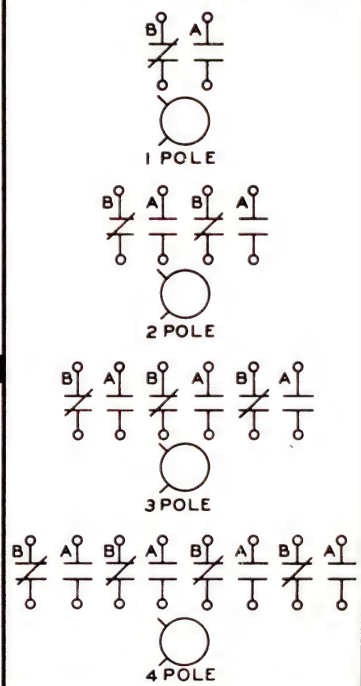
O—Normally Open Contact
X—Normally Closed Contact
*Contacts of Individual Double Throw Poles must be used on the same polarity.

Type DDO

Type DEO

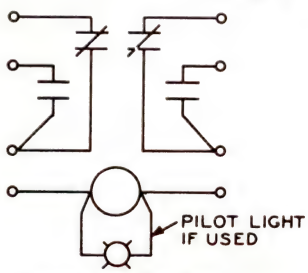
TYPE P, 10 AMPERE RELAY

55

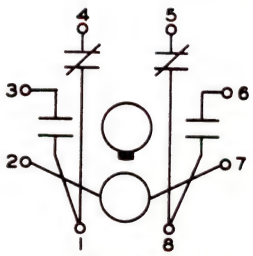


TYPE F RELAY

56



Type FO, FBO or FSO

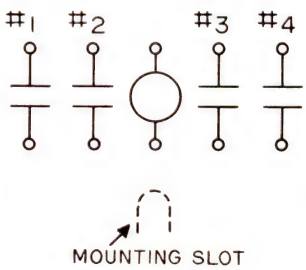


Type FPO
Octal Plug-in, Bottom View

TYPE G, 10 AMPERE RELAY, CONVERTIBLE CONTACTS

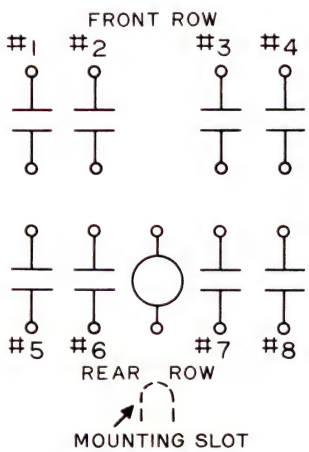
57

2, 3 and 4 Pole Contact Arrangement



No. of Poles	Type	Contact Number			
		1	2	3	4
2	GO-20	O			O
	GO-11	O			X
	GO-02	X			X
3	GO-30	O		O	O
	GO-21	O		O	X
	GO-12	O		X	X
	GO-03	X		X	X
4	GO-40	O	O	O	O
	GO-31	O	O	O	X
	GO-22	O	O	X	X
	GO-13	O	X	X	X
	GO-04	X	X	X	X

6 and 8 Pole Contact Arrangement



No. of Poles	Type	Contact Number			
		1 5	2 6	3 7	4 9
6	GO-60	O O	O	O	O O
	GO-51	O O	O	O	X O
	GO-42	O O	O	X	X O
	GO-33	O O	X	X	X O
	GO-24	X O	X	X	X O
	GO-15	O X	X	X	X X
	GO-06	X X	X	X	X X
8	GO-80	O O	O O	O O	O O
	GO-71	O O	O O	O O	X O
	GO-62	O O	O X	X X	X X
	GO-53	O X	O X	O X	O X
	GO-44	O O	O O	O O	X O
	GO-35	O X	O X	X X	X X
	GO-26	O X	X X	X X	X X
	GO-17	O X	X X	X X	X X
	GO-08	X X	X X	X X	X X

Note: Class 8501 Type GO—GL mechanically held relays have same contact arrangements as above except unlatch coil is added to diagram.

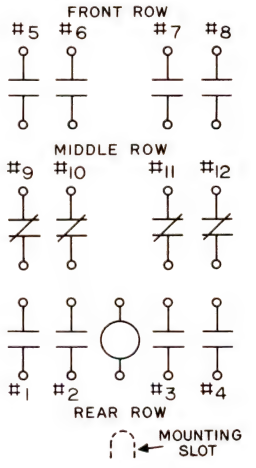
O—Normally Open Contact
X—Normally Closed Contact

CLASS 8501
AC MAGNETIC RELAYS

58

TYPE G, 10 AMPERE RELAY WITH UNIVERSAL POLE ATTACHMENT

8, 10 and 12 Pole Contact Arrangement



O—Normally Open Contact
X—Normally Closed Contact

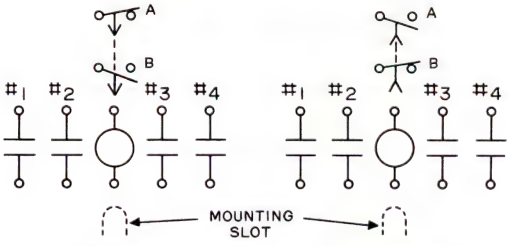
No. of Poles	Type	Contact Number * 5	6	7	8
		9	10	11	12
		1	2	3	4
8	GO-00-GU-44	O	O	O	O
		X	X	X	X
		—	—	—	—
10	GO-20-GU-44	O	O	O	O
		X	X	X	X
		O	—	—	O
	GO-11-GU-44	O	O	O	O
		X	X	X	X
		O	—	—	X
	GO-02-GU-44	O	O	O	O
		X	X	X	X
		X	—	—	X
12	GO-40-GU-44	O	O	O	O
		X	X	X	X
		O	O	O	O
	GO-31-GU-44	O	O	O	O
		X	X	X	X
		O	O	O	X
	GO-22-GU-44	O	O	O	O
		X	X	X	X
		O	O	X	X
	GO-13-GU-44	O	O	O	O
		X	X	X	X
		O	X	X	X
	GO-04-GU-44	O	O	O	O
		X	X	X	X
		X	X	X	X

*Poles 1, 2, 3 and 4 Convertible
Poles 5, 6, 7, 8, 9, 10, 11 and 12 non-convertible.

59

TYPE G, RELAY OPERATED TIMER

• Contact Arrangement



Type GO-GD

O—Normally Open Contact
X—Normally Closed Contact

Type GO-GE

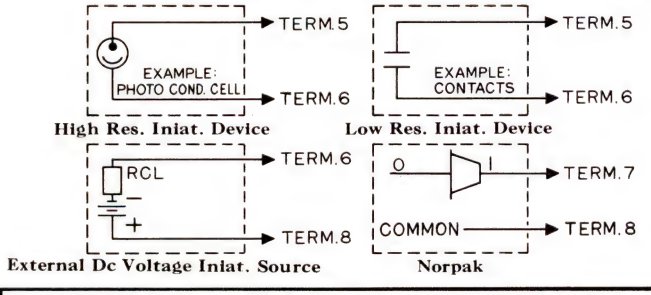
Instantaneous Contacts

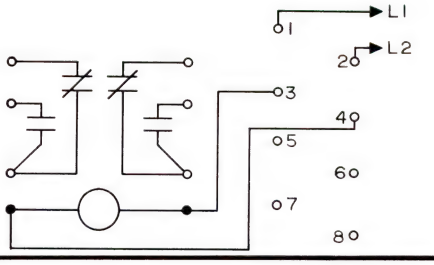
No. of Poles	Type	Contact Number 1	2	3	4
0	GO-00	—	—	—	—
2	GO-20	O	—	—	O
	GO-11	O	—	—	X
	GO-02	X	—	—	X
3	GO-30	O	—	O	O
	GO-21	O	—	O	X
	GO-12	O	—	X	X
	GO-03	X	—	X	X
4	GO-40	O	O	O	O
	GO-31	O	O	O	X
	GO-22	O	O	X	X
	GO-13	O	X	X	X
	GO-04	X	X	X	X

CLASS 8501
AC SOLID STATE RELAYS

60

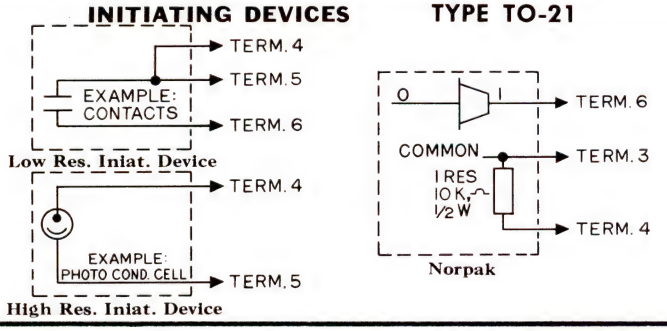
INITIATING DEVICES TYPE TO-20

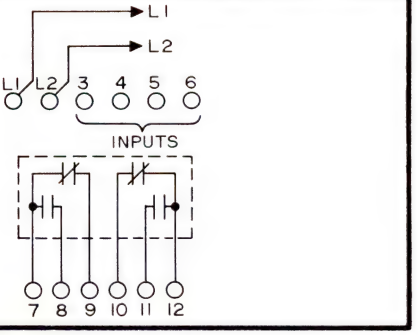




61

INITIATING DEVICES TYPE TO-21

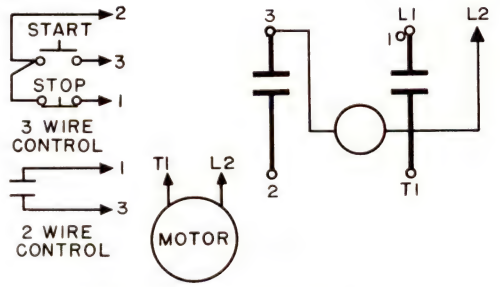




• Revised—12/67

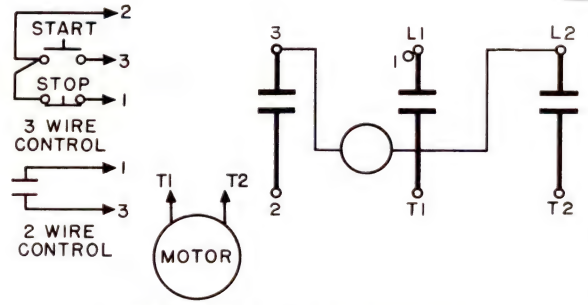
TYPE S SIZES 0, 1 AND 2

62



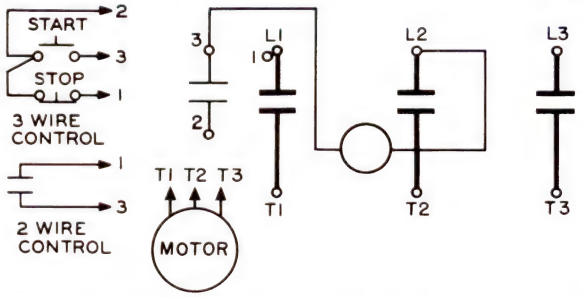
Type S, Sizes 0 and 1, 1 Pole Contactors

63



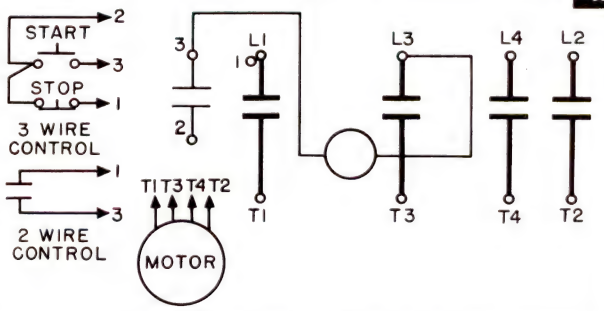
Type S, Sizes 0 and 1, 2 Pole Contactors

64



Type S, Sizes 0 and 1, 3 Pole Contactors

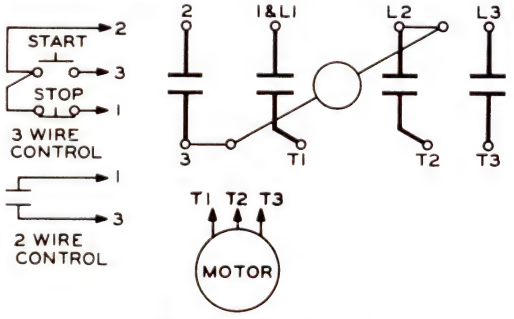
65



Type S, Sizes 0 and 1, 4 Pole Contactors

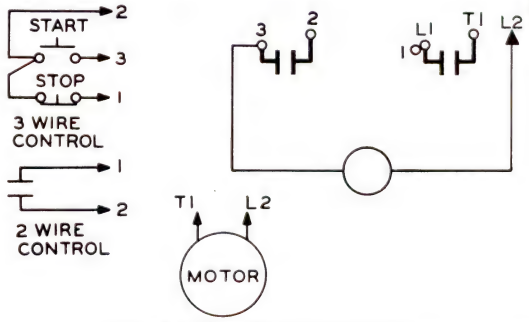
TYPES A THRU K, SIZES 00, 0, 1, 2, 3, 4, 5, 6, 7 AND 8

66



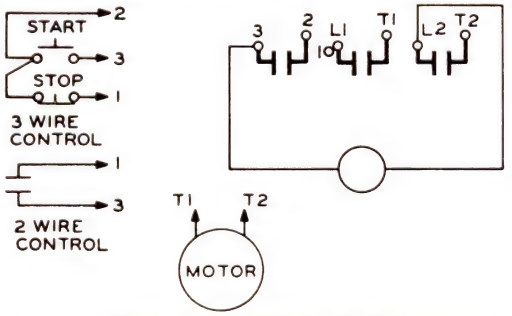
Size 00, 3 Pole Contactor

67



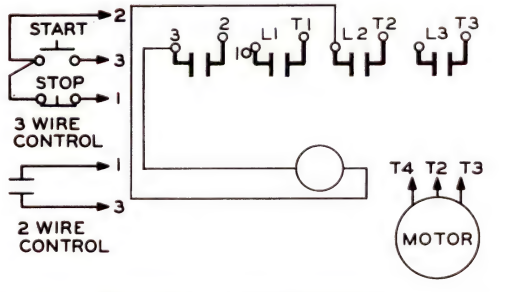
Sizes 0 and 1, 1 Pole Contactors

68



Sizes 0 and 1, 2 Pole Contactors

69

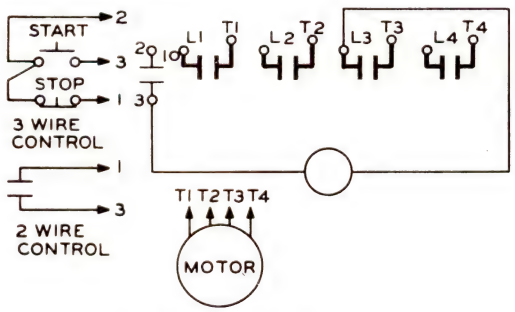


Size 0 and 1, 3 Pole Contactors

CLASS 8502
AC MAGNETIC CONTACTORS

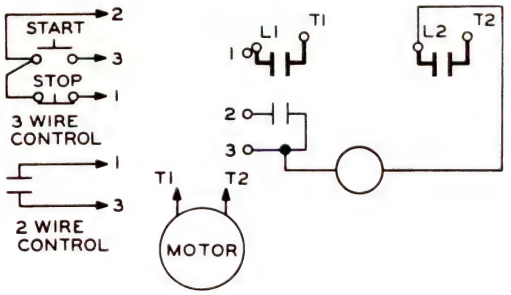
TYPES A THRU K, SIZES 00, 0, 1, 2, 3, 4, 5, 6, 7 AND 8 (Cont'd)

70



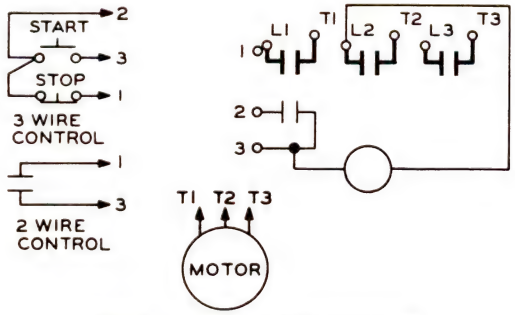
Sizes 0 and 1, 4 Pole Contactors

71



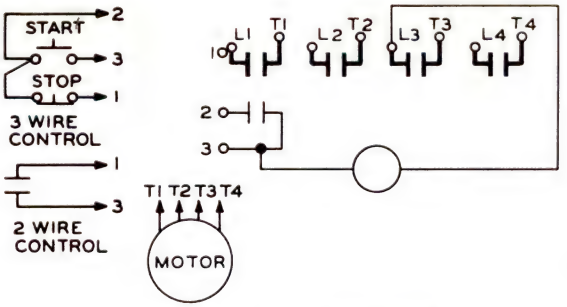
Sizes 2, 3, 4 and 5, 2 Pole Contactors

72



Size 2, 3, 4 and 5, 3 Pole Contactors

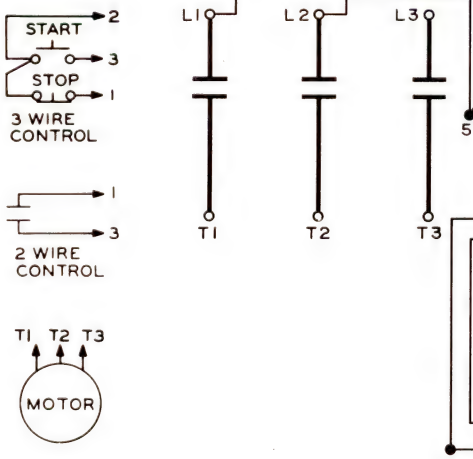
73



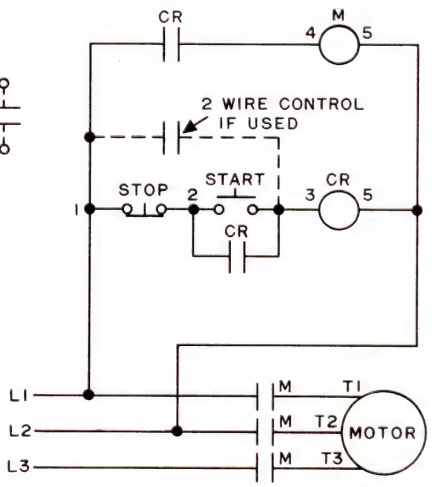
Sizes 2, 3, 4 and 5, 4 Pole Contactors

74

Wiring Diagram



Elementary Diagram

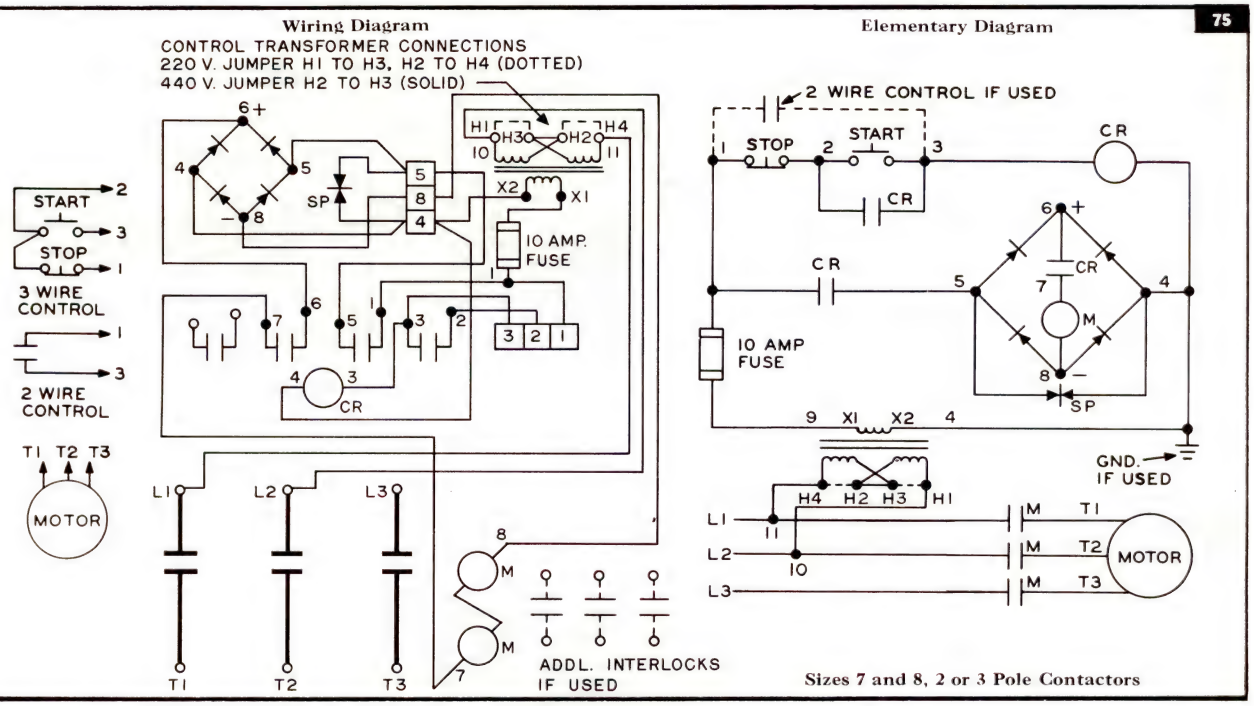


Size 6, 2 or 3 Pole Contactors

CLASS 8502
AC MAGNETIC CONTACTORS

TYPES A THRU K, SIZES 00, 0, 1, 2, 3, 4, 5, 6, 7, AND 8 (Cont'd)

75

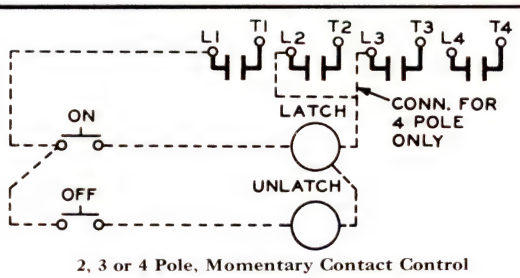


Sizes 7 and 8, 2 or 3 Pole Contactors

CLASS 8508
AC MECHANICALLY HELD MAGNETIC CONTACTORS

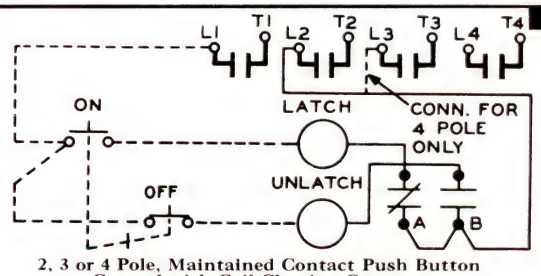
SIZES 1, 2 & 3

76



2, 3 or 4 Pole, Momentary Contact Control

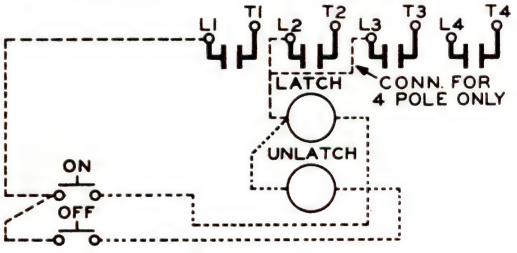
77



2, 3 or 4 Pole, Maintained Contact Push Button Control with Coil Clearing Contacts

SIZE 4

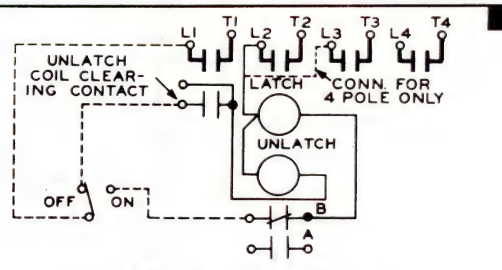
78



2, 3 or 4 Pole, Momentary Contact Control

Note: For 2 Pole Device: L1-T1 and L2-T2 provided.
For 3 Pole Device: L1-T1, L2-T2, and L3-T3 provided.
For 4 Pole Device: L1-T1, L2-T2, L3-T3 and L4-T4 provided.

79

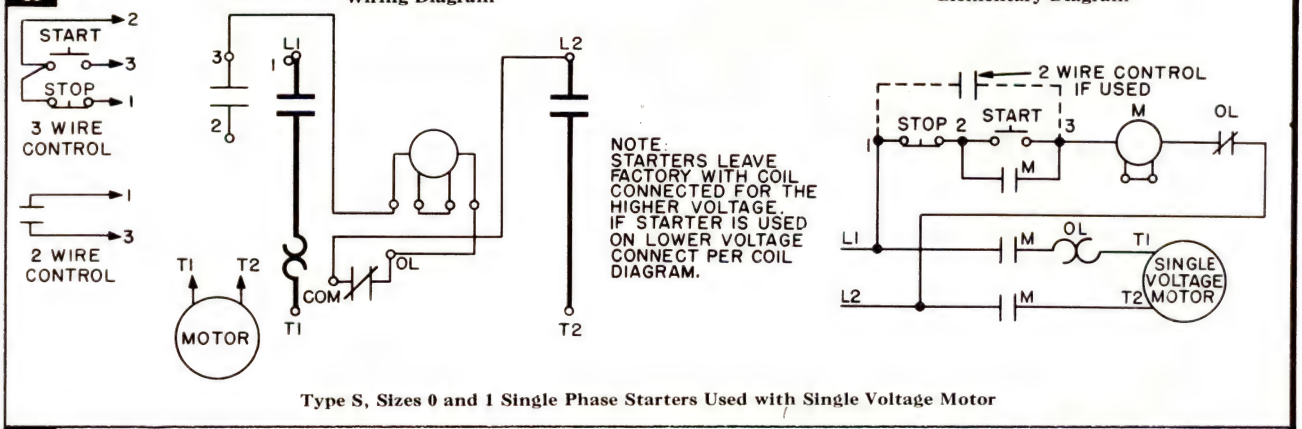


2, 3 or 4 Pole, Maintained Contact Control with Coil Clearing Contacts

CLASS 8536

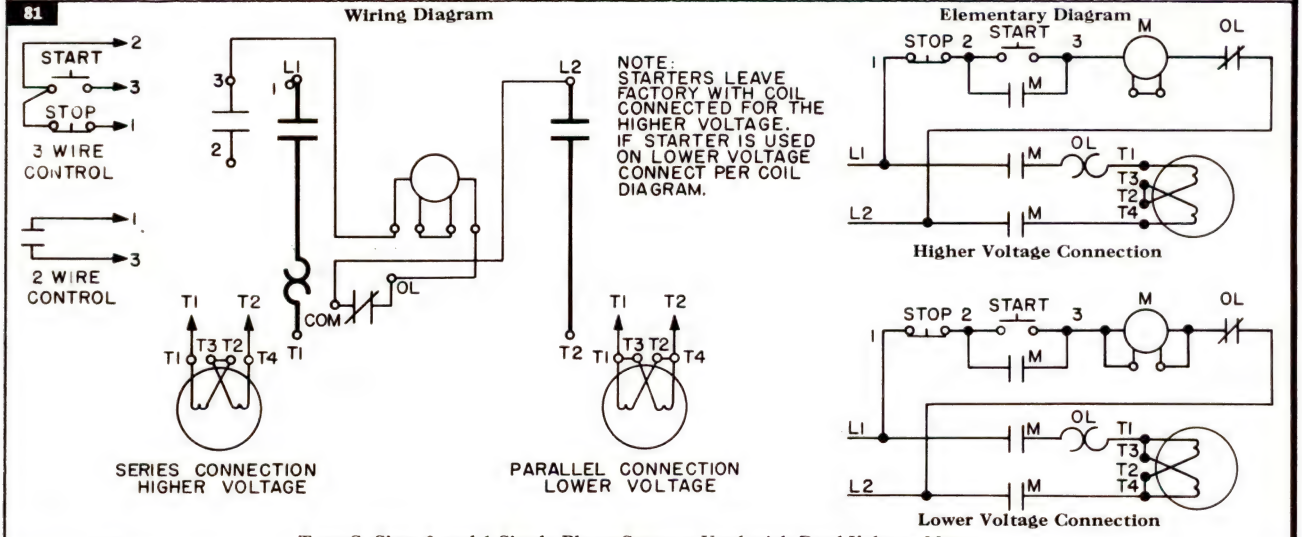
TYPE S AC LINE VOLTAGE MAGNETIC STARTERS — SINGLE PHASE

80



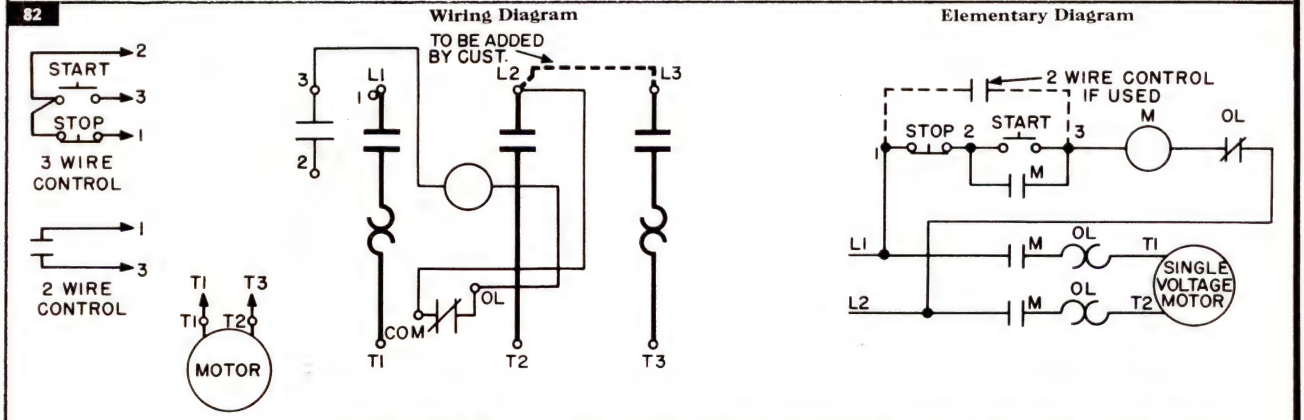
Type S, Sizes 0 and 1 Single Phase Starters Used with Single Voltage Motor

81



Type S, Sizes 0 and 1 Single Phase Starters Used with Dual Voltage Motor

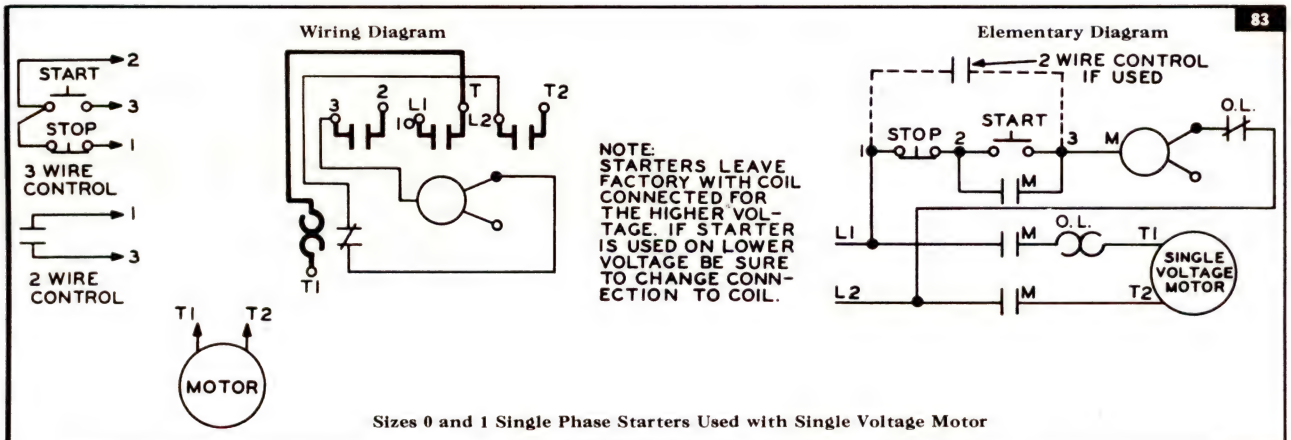
82



Standard Sizes 0 and 1, 3 Pole, 3 Phase Starters Connected for Single Phase, Single Voltage Motor

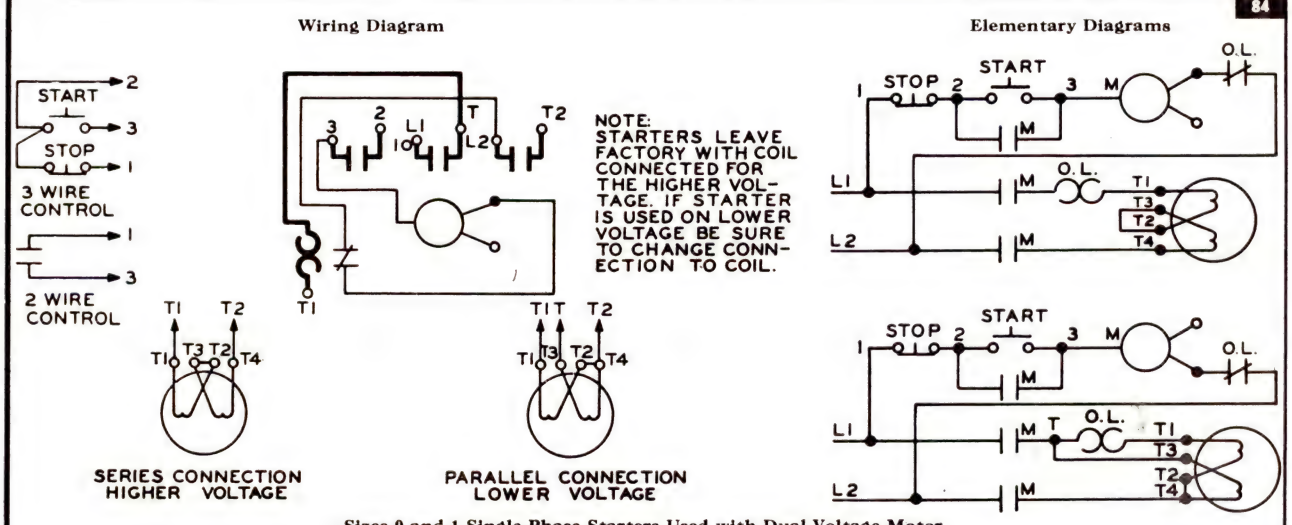
CLASS 8536
TYPES B & C AC LINE VOLTAGE MAGNETIC STARTERS — SINGLE PHASE

83



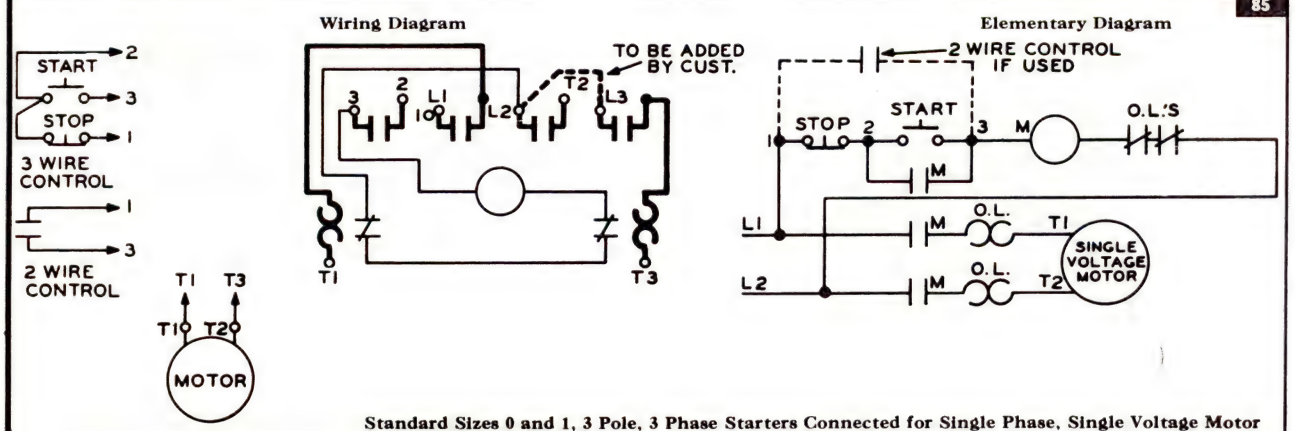
Sizes 0 and 1 Single Phase Starters Used with Single Voltage Motor

84



Sizes 0 and 1 Single Phase Starters Used with Dual Voltage Motor

85



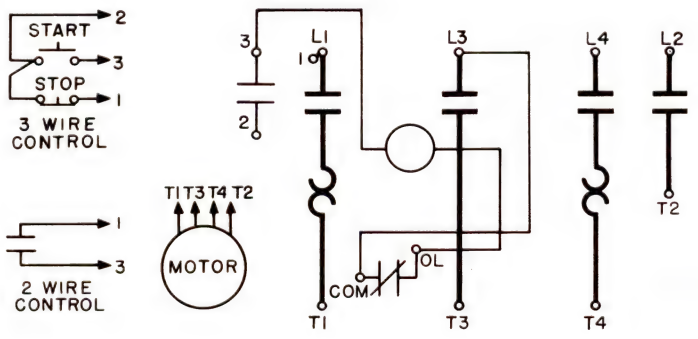
Standard Sizes 0 and 1, 3 Pole, 3 Phase Starters Connected for Single Phase, Single Voltage Motor

CLASS 8536
TYPE S AC LINE VOLTAGE MAGNETIC STARTERS — TWO PHASE

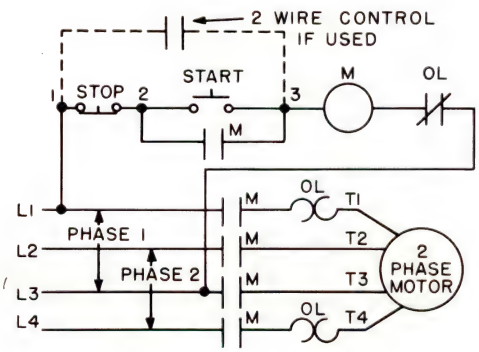
SIZES 0, 1 AND 2

86

Wiring Diagram



Elementary Diagram

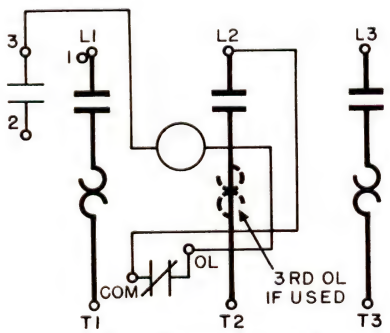


Type S, Sizes 0, 1 and 2, 4 Pole, 2 Phase, 4 Wire Starters with External 2 or 3 Wire Control

87

STANDARD 3 POLE, 3 PHASE STARTERS CONNECTED FOR 2 PHASE, 3 OR 4 WIRE

Wiring Diagram



Type S, Sizes 0, 1 and 2

	LINE CONNECTIONS				LOAD CONNECTIONS			
STARTER MARKINGS	L1	L2	L3	—	T1	T2	T3	—
FOR 2 Ø 3 WIRE	L1	L3	L2	—	T1	T4 T3	T2	—
FOR 2 Ø 4 WIRE	L1	L3	L2	L4 TO T4	T1	T3	T2	T4 TO L4

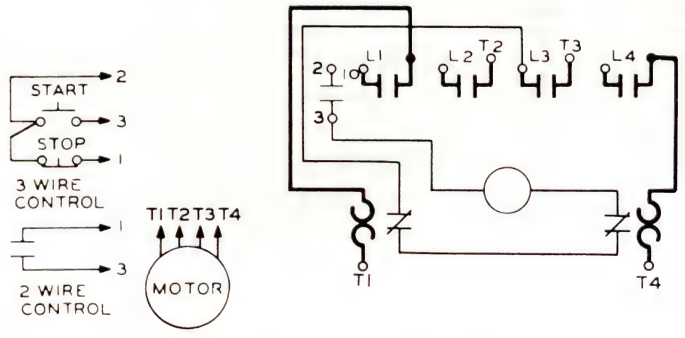
FOR 2 PHASE CONNECTIONS USING THREE POLE STARTER, CONNECT LINE AND MOTOR TERMINALS TO THE STARTER TERMINAL IN THE SAME COLUMN.

CLASS 8536
TYPES B THRU G AC LINE VOLTAGE MAGNETIC STARTERS — TWO PHASE

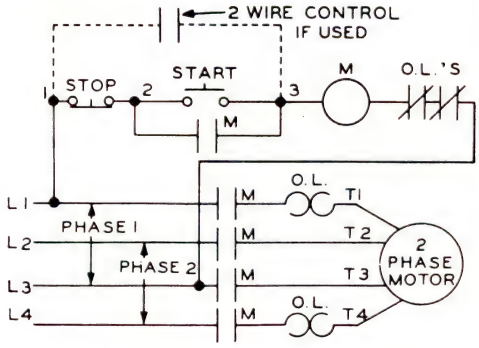
88

SIZES 0 & 1

Wiring Diagram



Elementary Diagram

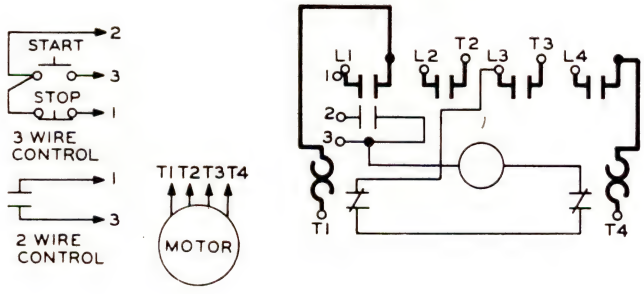


Sizes 0 and 1, 4 Pole, 2 Phase, 4 Wire Starters With External 2 or 3 Wire Control

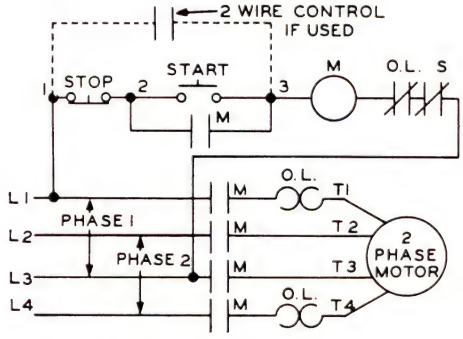
89

SIZES 2, 3, 4 & 5

Wiring Diagram



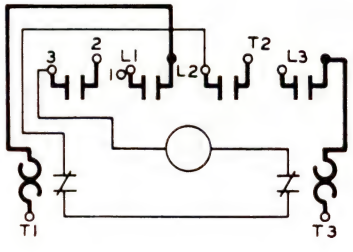
Elementary Diagram



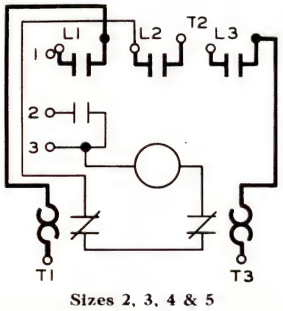
Size 2, 3, 4, & 5, 4 Pole, 2 Phase, 4 Wire Starters With External 2 or 3 Wire Control

90

STANDARD 3 POLE, 3 PHASE STARTERS CONNECTED FOR 2 PHASE, 3 OR 4 WIRE



Size 0 and 1



Sizes 2, 3, 4 & 5

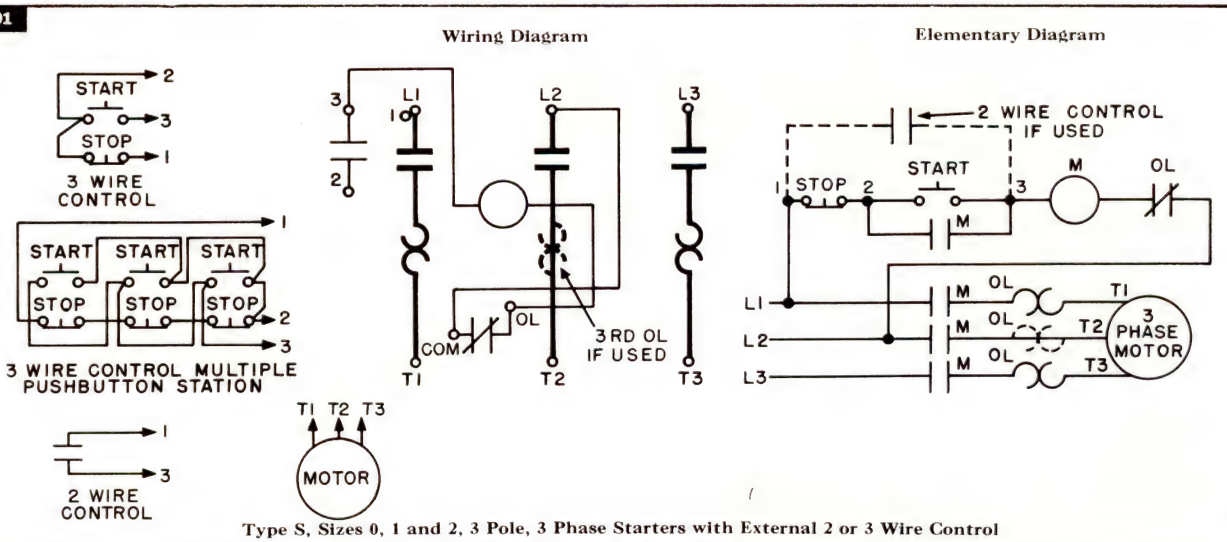
	LINE CONNECTIONS				LOAD CONNECTIONS			
STARTER MARKINGS	L1	L2	L3	—	T1	T2	T3	—
FOR 2 Ø 3 WIRE	L1	L3	L2	—	T1	T4 T3	T2	—
FOR 2 Ø 4 WIRE	L1	L3	L2	L4 TO T4	T1	T3	T2	T4 TO L4

FOR 2 PHASE CONNECTIONS USING THREE POLE STARTER, CONNECT LINE AND MOTOR TERMINALS TO THE STARTER TERMINAL IN THE SAME COLUMN.

CLASS 8536
TYPE S AC LINE VOLTAGE MAGNETIC STARTERS — THREE PHASE

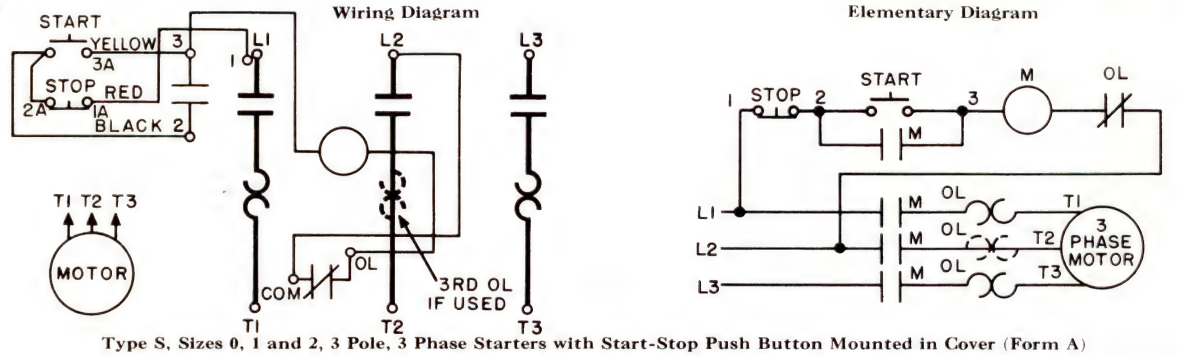
SIZES 0, 1 AND 2

91



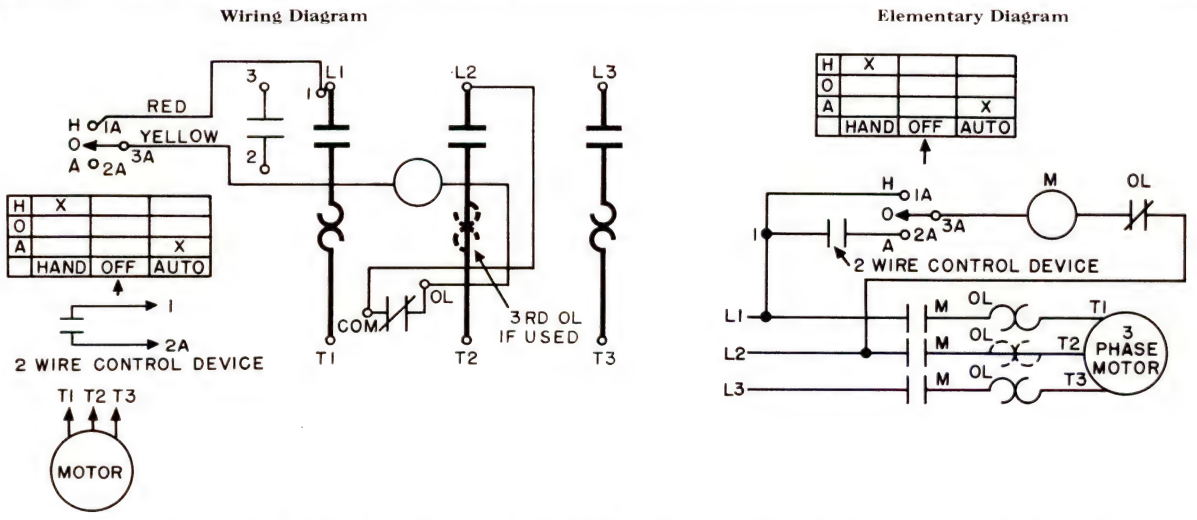
Type S, Sizes 0, 1 and 2, 3 Pole, 3 Phase Starters with External 2 or 3 Wire Control

92



Type S, Sizes 0, 1 and 2, 3 Pole, 3 Phase Starters with Start-Stop Push Button Mounted in Cover (Form A)

93



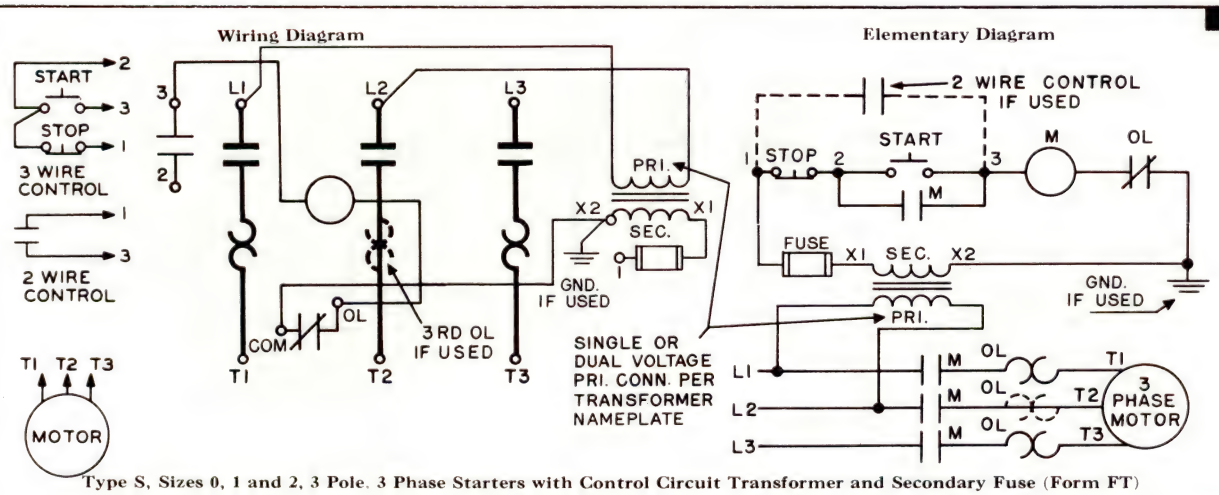
Type S, Sizes 0, 1 and 2, 3 Pole, 3 Phase Starters with Hand-Off-Auto Selector Switch Mounted in Cover (Form C)

CLASS 8536

AC LINE VOLTAGE MAGNETIC STARTERS — THREE PHASE — TYPE S

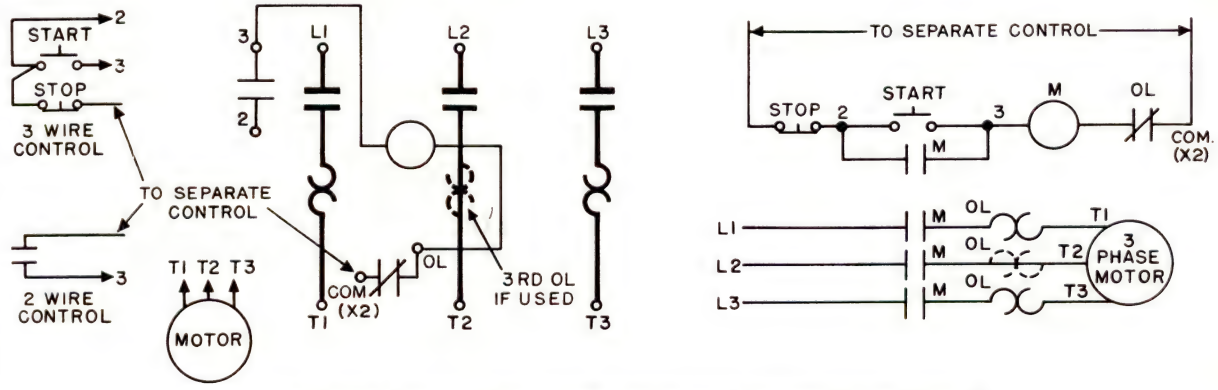
ADDITIONS AND SPECIAL FEATURES (Cont'd)

94



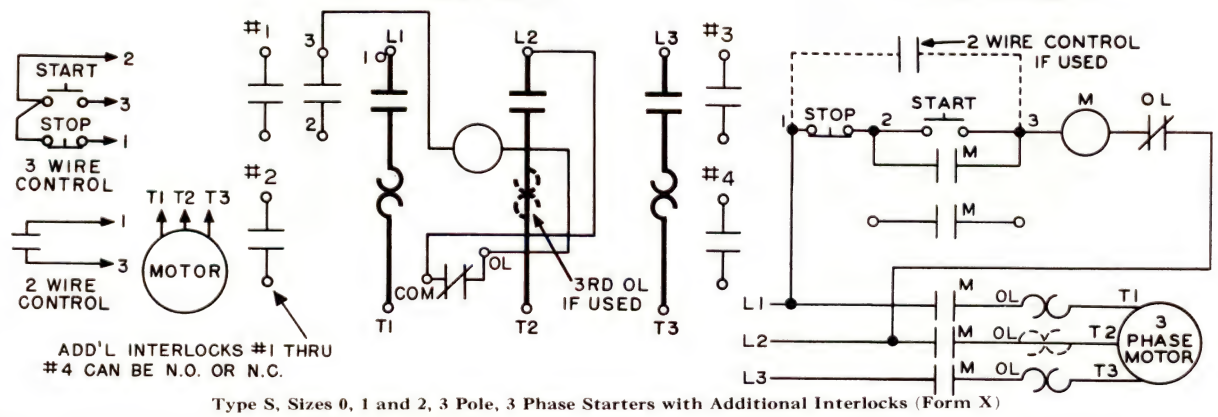
Type S, Sizes 0, 1 and 2, 3 Pole, 3 Phase Starters with Control Circuit Transformer and Secondary Fuse (Form FT)

95



Type S, Sizes 0, 1 and 2, 3 Pole, 3 Phase Starters with Separate Control (Form S)

96



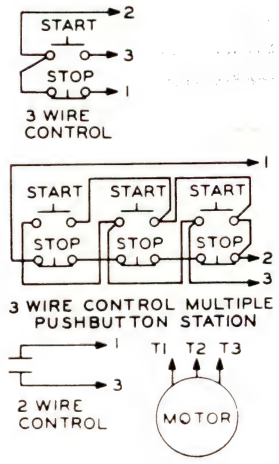
Type S, Sizes 0, 1 and 2, 3 Pole, 3 Phase Starters with Additional Interlocks (Form X)

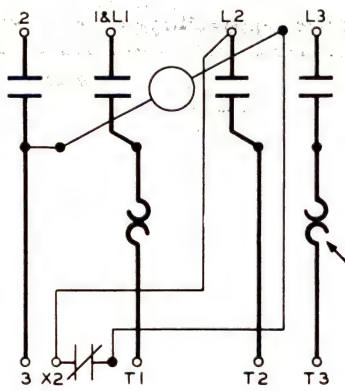
CLASS 8536
TYPES A THRU H AC LINE VOLTAGE MAGNETIC STARTERS — THREE PHASE

SIZE 00

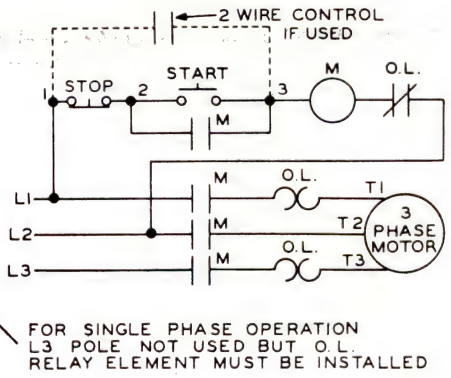
97

Wiring Diagram





Elementary Diagram

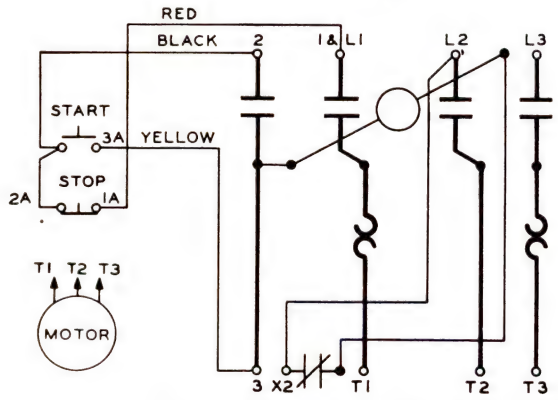


FOR SINGLE PHASE OPERATION L3 POLE NOT USED BUT O.L. RELAY ELEMENT MUST BE INSTALLED

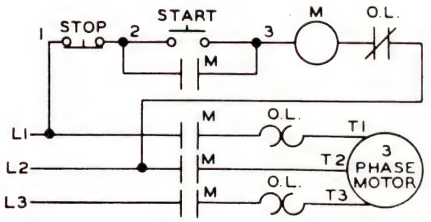
Size 00, 3 Pole, 3 Phase Starter With External 2 or 3 Wire Control

98

Wiring Diagram



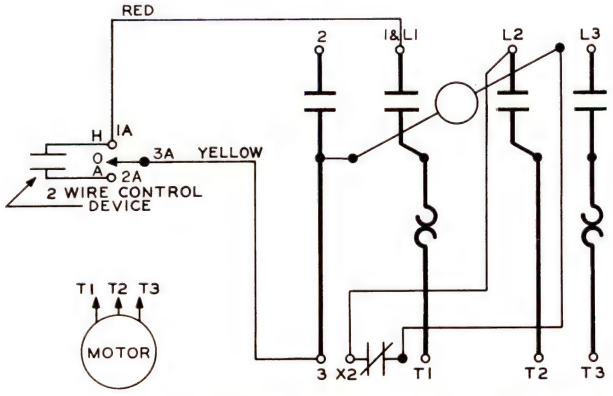
Elementary Diagram



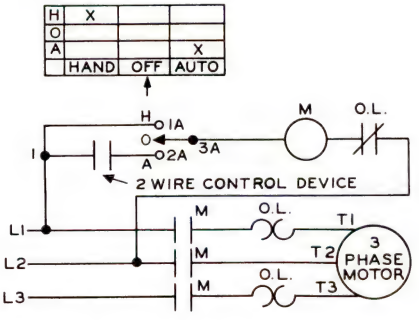
Size 00, 3 Pole, 3 Phase Starter With Start-Stop Push Button Mounted in Cover (Form A)

99

Wiring Diagram



Elementary Diagram



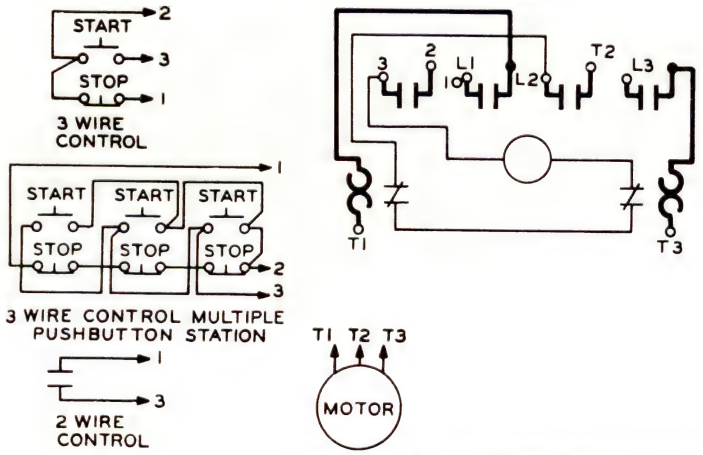
Size 00, 3 Pole, 3 Phase Starter With Hand-Off-Auto Selector Switch Mounted in Cover (Form C)

CLASS 8536
AC LINE VOLTAGE MAGNETIC STARTERS — THREE PHASE — TYPES A THRU H
(Cont'd)

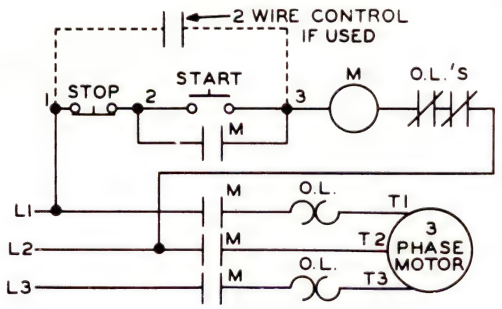
SIZES 0 & 1

100

Wiring Diagram



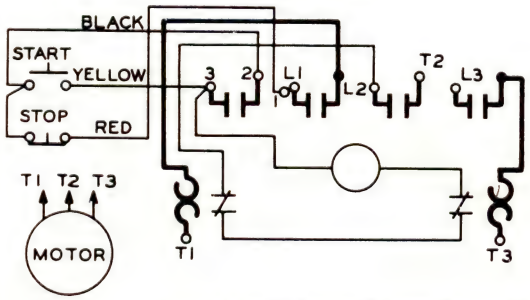
Elementary Diagram



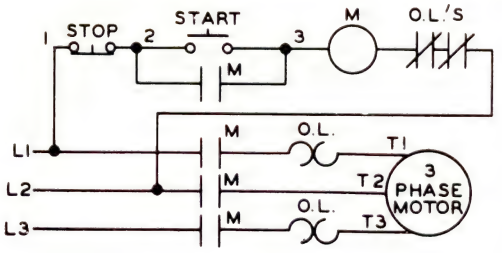
Sizes 0 and 1, 3 Pole, 3 Phase Starters With External 2 or 3 Wire Control

101

Wiring Diagram



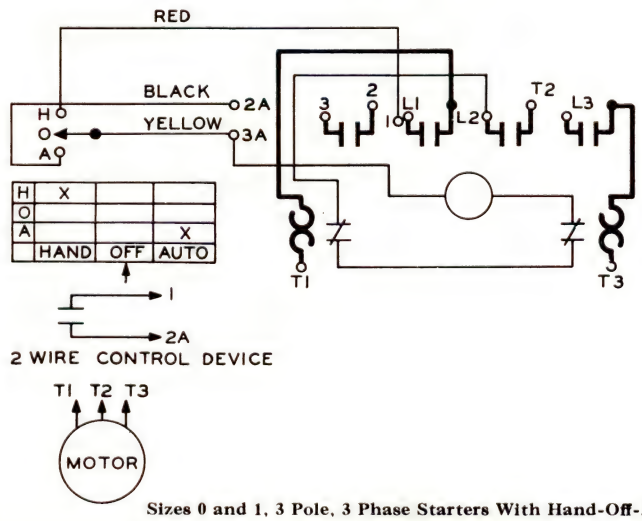
Elementary Diagram



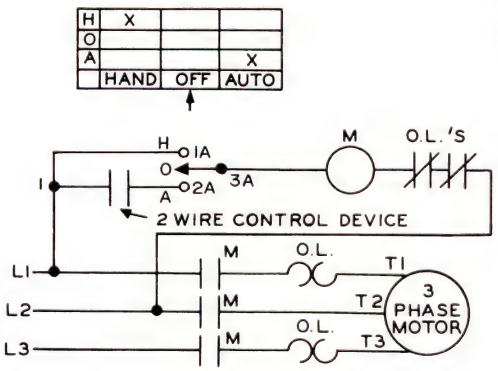
Sizes 0 and 1, 3 Pole, 3 Phase Starters With Start-Stop Push Button Mounted in Cover (Form A)

102

Wiring Diagram



Elementary Diagram



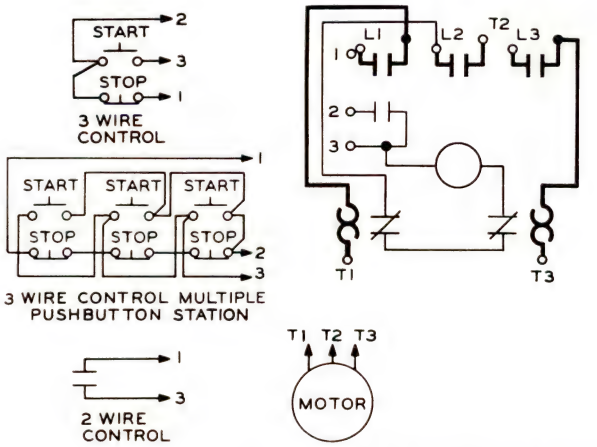
Sizes 0 and 1, 3 Pole, 3 Phase Starters With Hand-Off-Auto Selector Switch Mounted in Cover (Form C)

CLASS 8536
TYPES A THRU H AC LINE VOLTAGE MAGNETIC STARTERS — THREE PHASE (Cont'd)

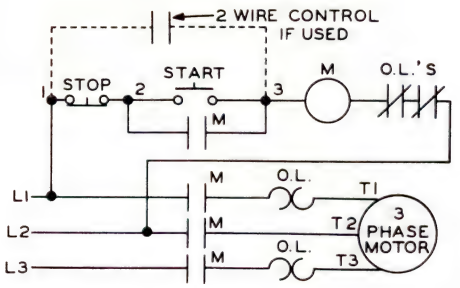
SIZES 2, 3, 4 & 5

103

Wiring Diagram



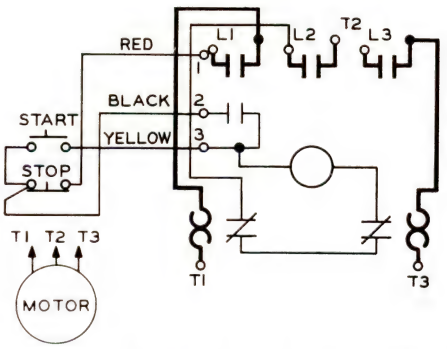
Elementary Diagram



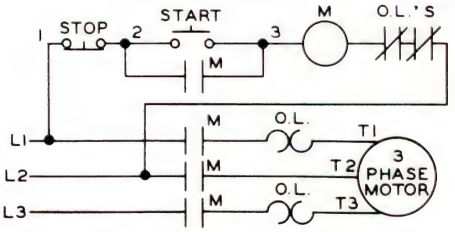
Sizes 2, 3, 4 & 5, 3 Pole, 3 Phase Starters With External 2 or 3 Wire Control

104

Wiring Diagram



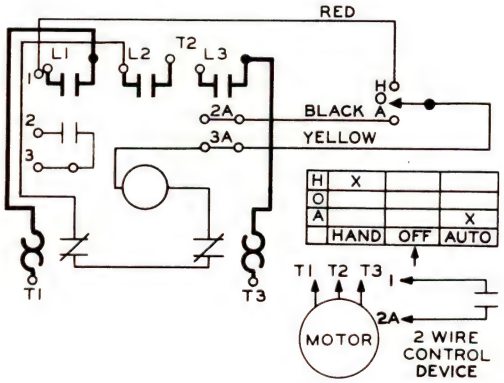
Elementary Diagram



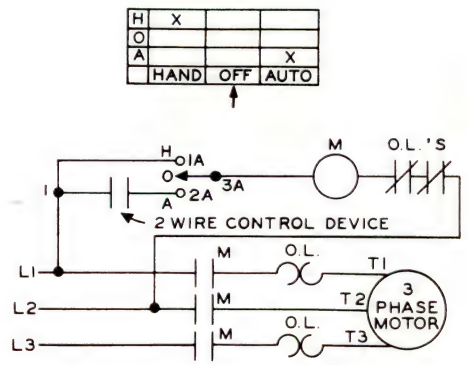
Sizes 2, 3, 4 & 5, 3 Pole, 3 Phase Starters With Start-Stop Push Button Mounted in Cover (Form A)

105

Wiring Diagram



Elementary Diagram

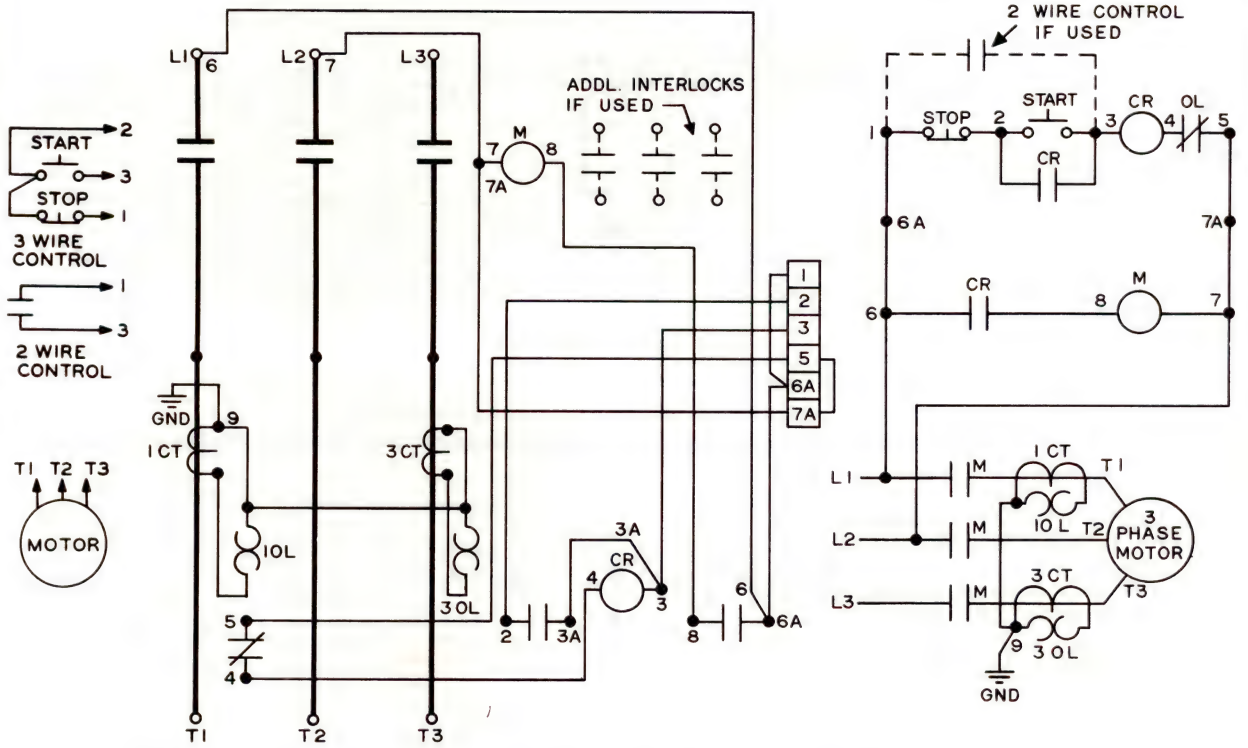


Sizes 2, 3, 4 & 5, 3 Pole, 3 Phase Starters With Hand-Off-Auto Selector Switch Mounted in Cover (Form C)

CLASS 8536
AC LINE VOLTAGE MAGNETIC STARTERS — THREE PHASE — TYPES A THRU H
(Cont'd)

SIZE 6

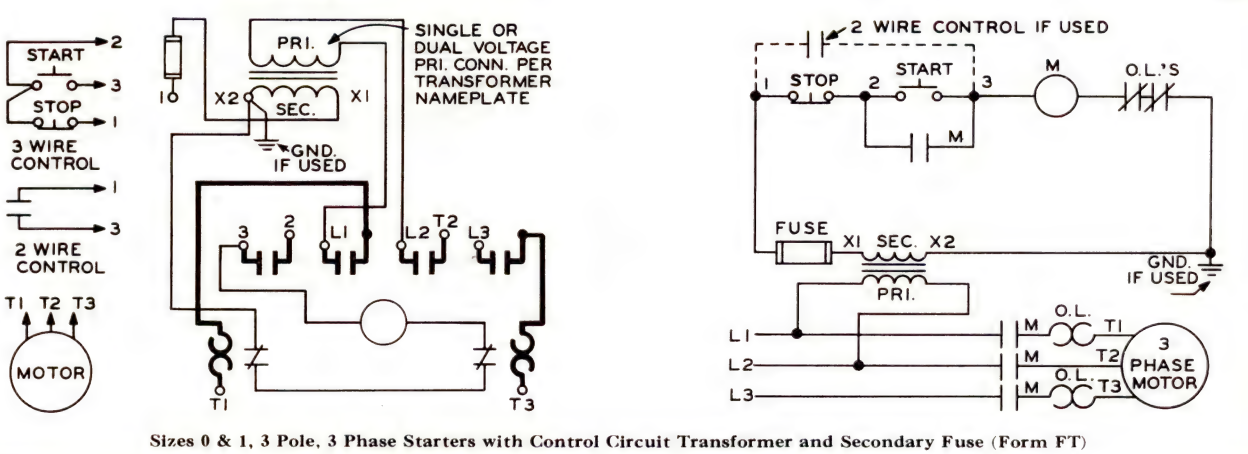
106



Size 6, 3 Pole, 3 Phase Starter with External 2 or 3 Wire Control

ADDITIONS AND SPECIAL FEATURES

107

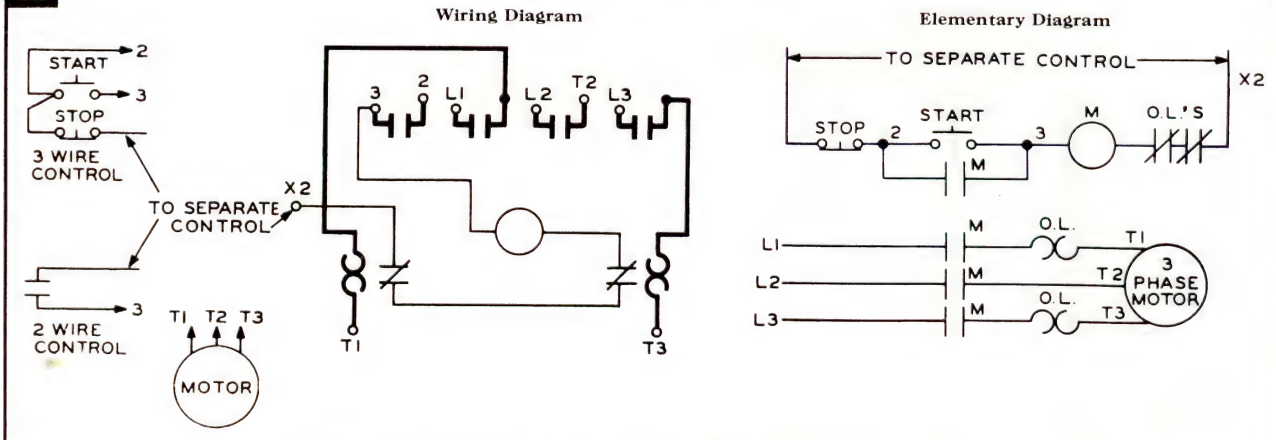


Sizes 0 & 1, 3 Pole, 3 Phase Starters with Control Circuit Transformer and Secondary Fuse (Form FT)

CLASS 8536
TYPES A THRU H AC LINE VOLTAGE MAGNETIC STARTERS — THREE PHASE (Cont'd)

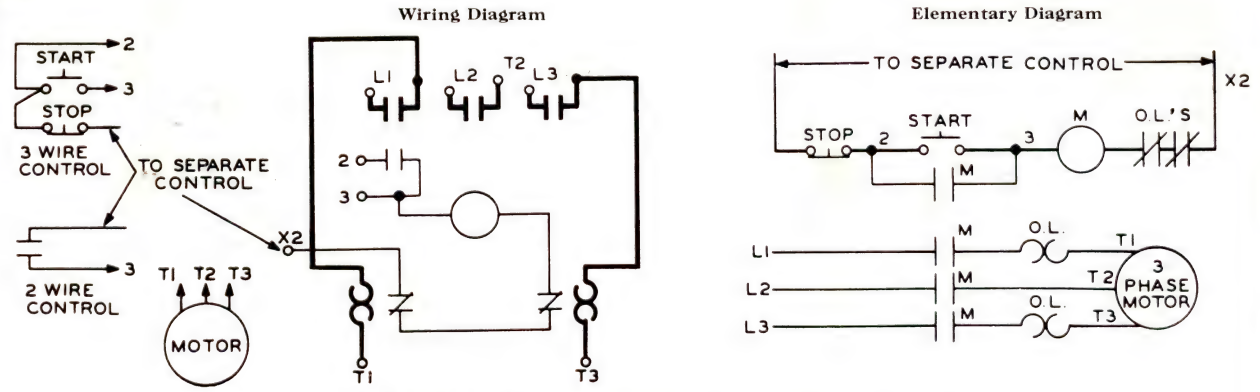
ADDITIONS AND SPECIAL FEATURES

108



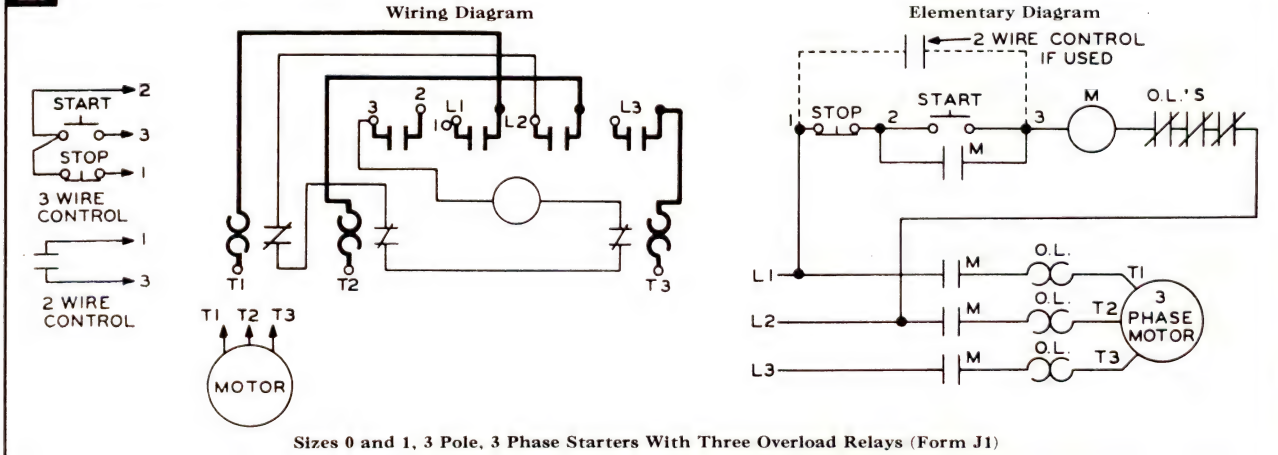
Sizes 0 and 1, 3 Pole, 3 Phase Starters With Separate Control (Form S)

109



Sizes 2, 3, 4 & 5, 3 Pole, 3 Phase Starters With Separate Control (Form S)

110

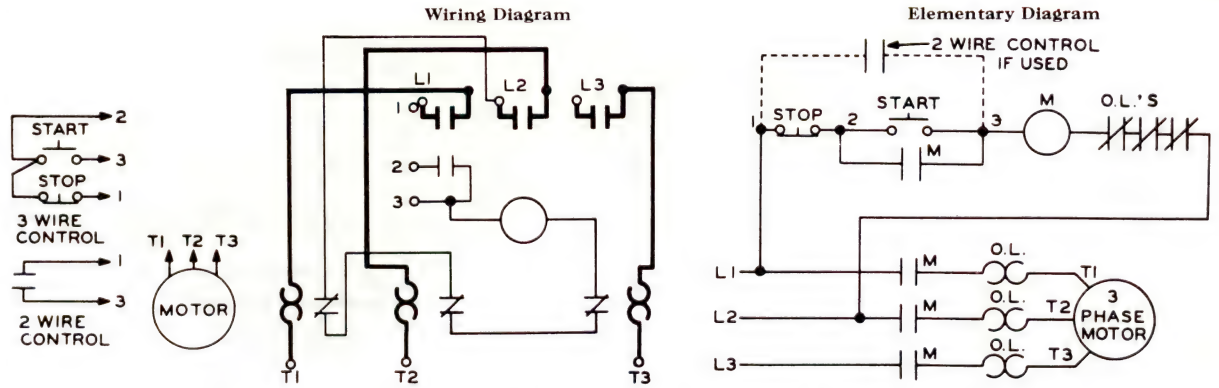


Sizes 0 and 1, 3 Pole, 3 Phase Starters With Three Overload Relays (Form J1)

CLASS 8536
AC LINE VOLTAGE MAGNETIC STARTERS — THREE PHASE — TYPES A THRU H
(Cont'd)

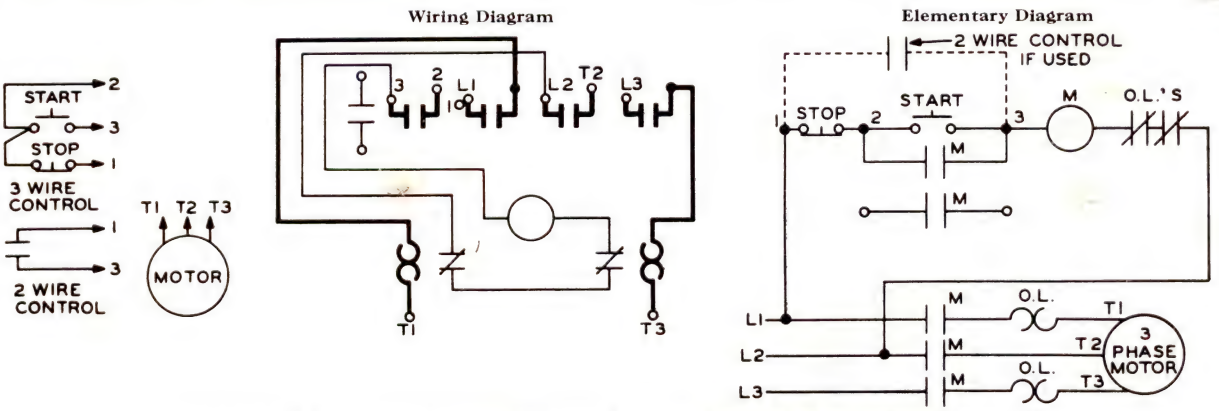
ADDITIONS AND SPECIAL FEATURES

111



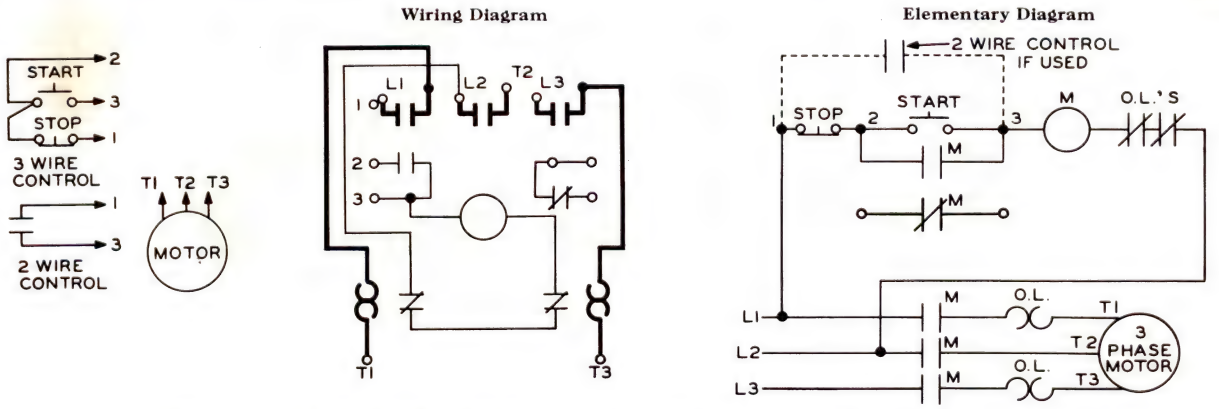
Sizes 2, 3, 4 & 5, 3 Pole, 3 Phase Starters With Three Overload Relays (Form J1)

112



Size 0 and 1, 3 Pole, 3 Phase Starters With One Additional Normally Open Interlock (Form X1)

113

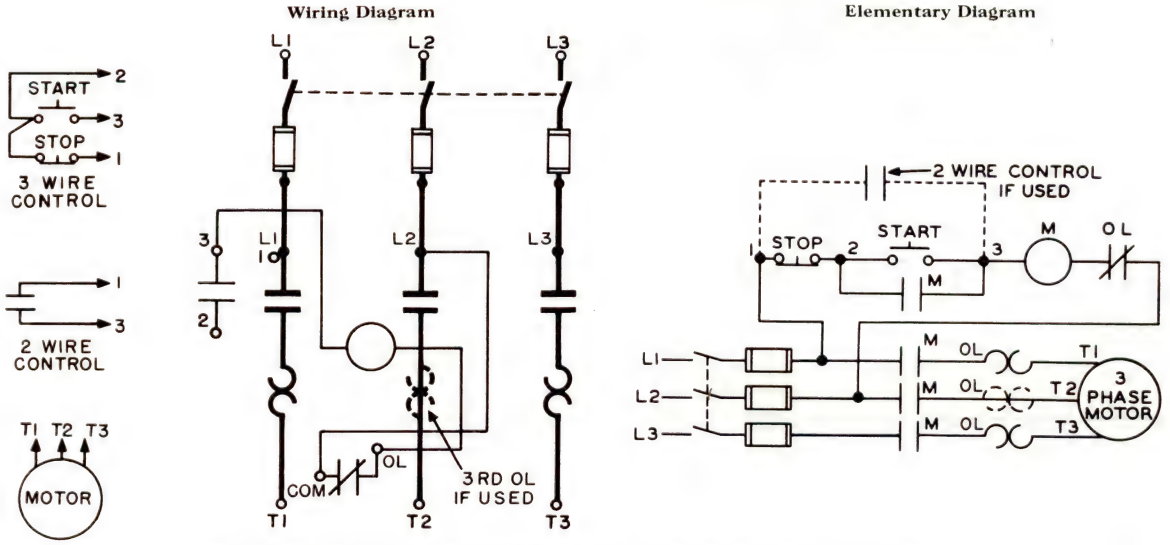


Sizes 2, 3, 4 & 5, 3 Pole, 3 Phase Starters With One Additional Normally Closed Interlock (Form X2)

CLASS 8538
TYPE S AC COMBINATION MAGNETIC STARTERS — SWITCH TYPE

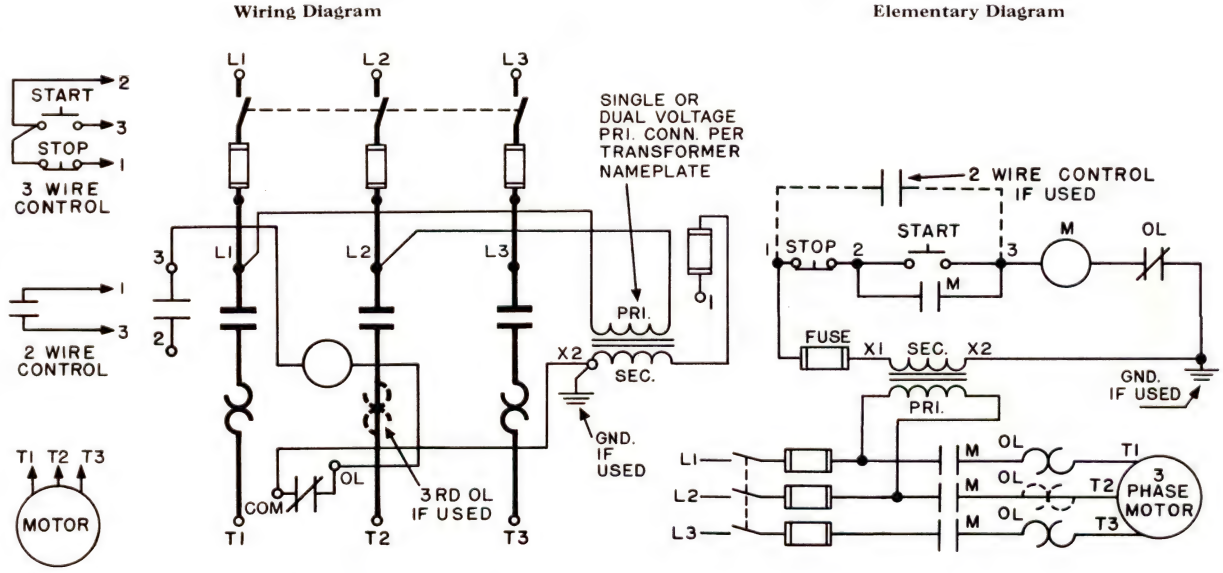
SIZES 0, 1 AND 2

114



Type S, Sizes 0, 1 and 2, Combination Starters with Fusible Disconnect Switch

115



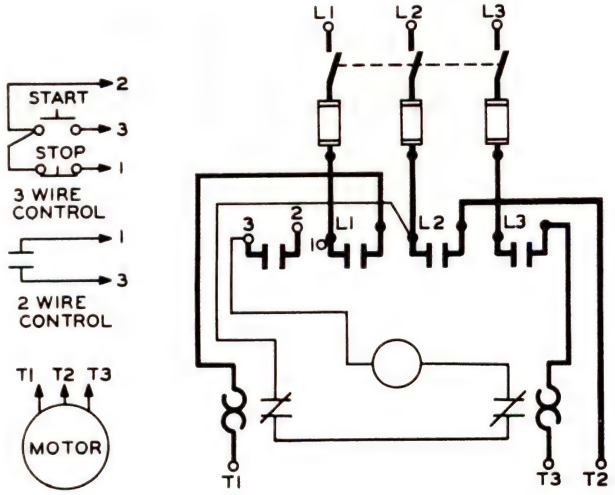
Type S, Sizes 0, 1 and 2 Combination Starters With Fusible Disconnect Switch, Control Circuit Transformer and Secondary Fuse (Form FT)

CLASS 8538
AC COMBINATION MAGNETIC STARTERS — SWITCH TYPE — TYPES B THRU G

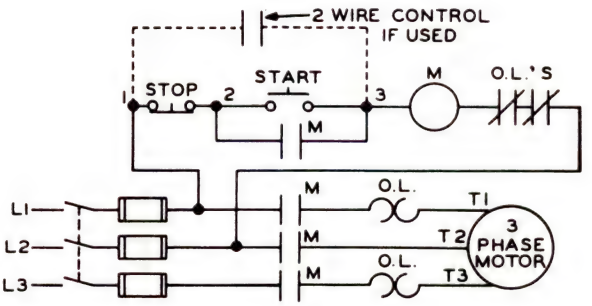
116

SIZES 0 & 1

Wiring Diagram



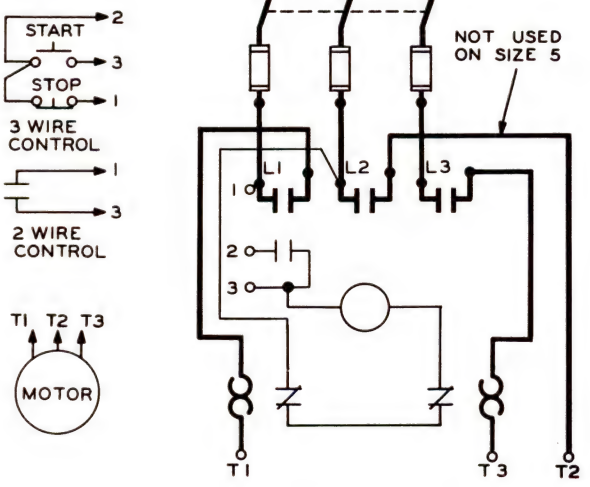
Elementary Diagram



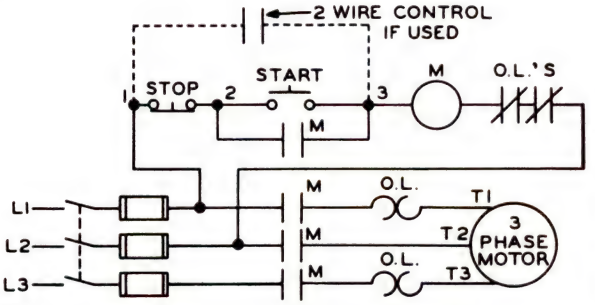
Sizes 0 & 1 Combination Starters With Fusible Disconnect Switch

117

Wiring Diagram



Elementary Diagram

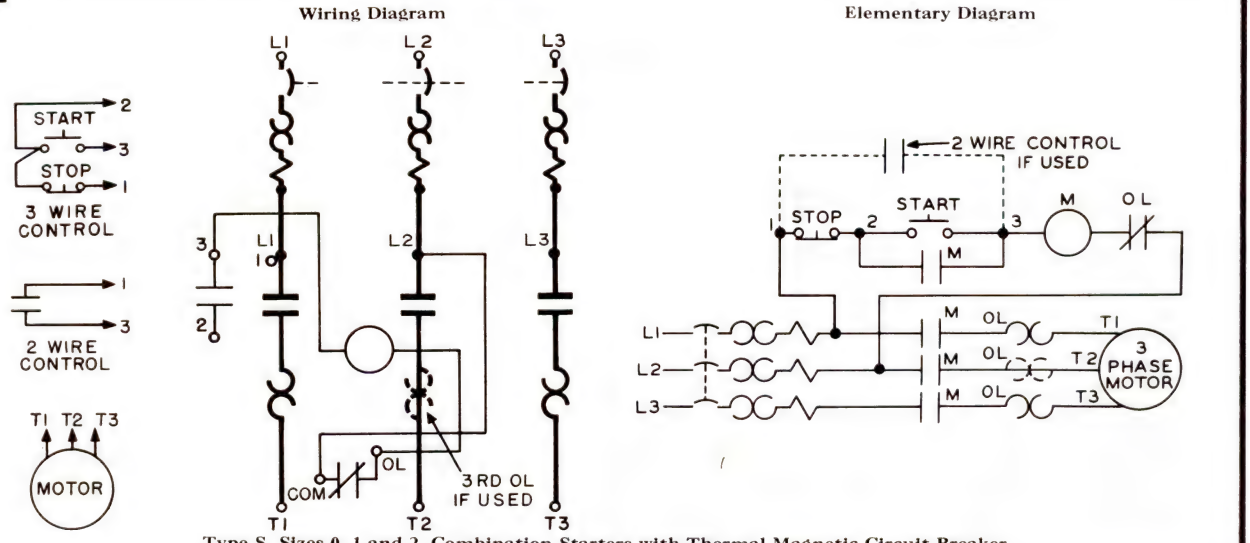


Sizes 2, 3, 4 and 5, Combination Starters with Fusible Disconnect Switch

CLASS 8539
AC COMBINATION MAGNETIC STARTERS — CIRCUIT BREAKER TYPE

TYPE S SIZES 0, 1 AND 2

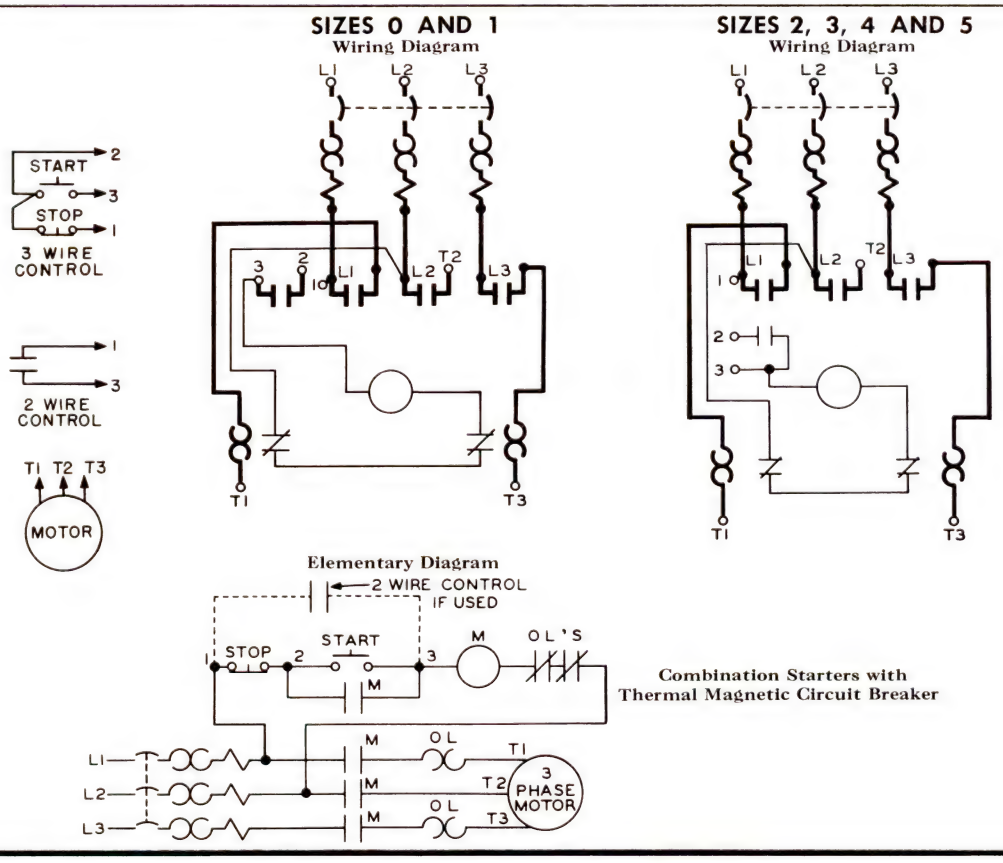
118



Type S, Sizes 0, 1 and 2, Combination Starters with Thermal Magnetic Circuit Breaker

TYPES B THRU G, SIZES 0, 1, 2, 3, 4 AND 5

119



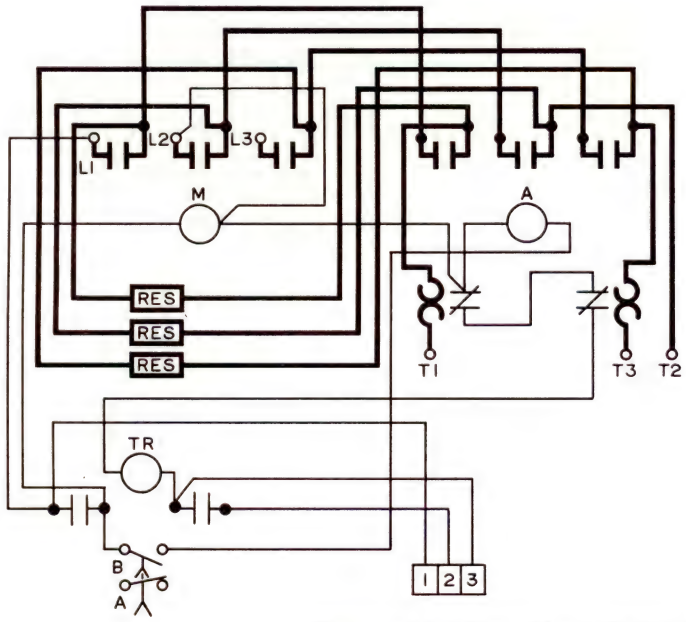
Combination Starters with Thermal Magnetic Circuit Breaker

CLASS 8547
AC REDUCED VOLTAGE STARTERS — PRIMARY RESISTOR TYPE

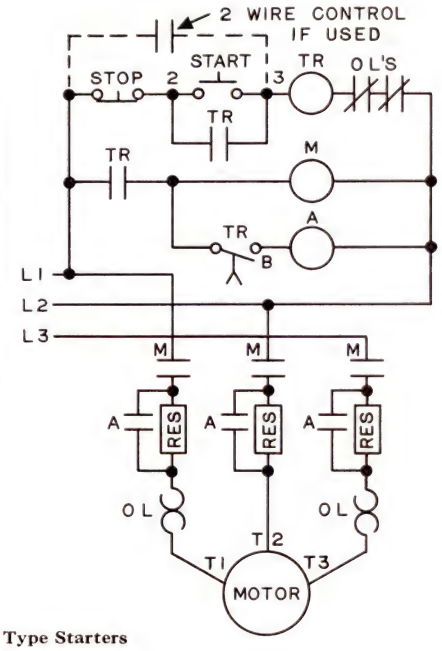
120

SIZES 3 AND 4

Wiring Diagram



Elementary Diagram

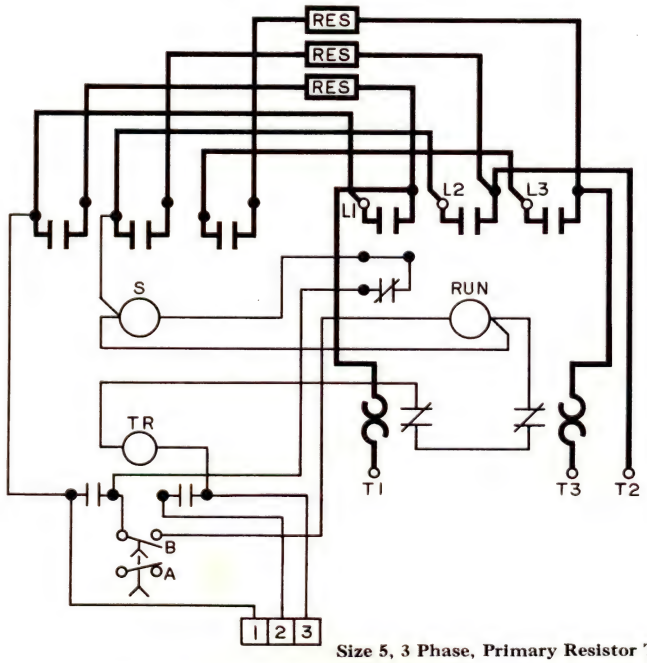


Sizes 3 and 4, 3 Phase, Primary Resistor Type Starters

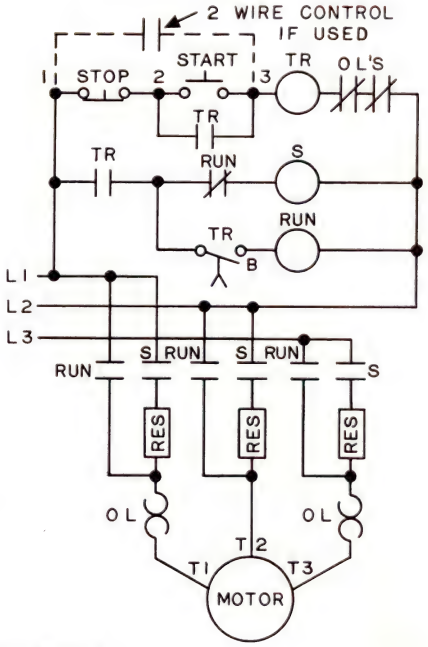
121

SIZE 5

Wiring Diagram



Elementary Diagram

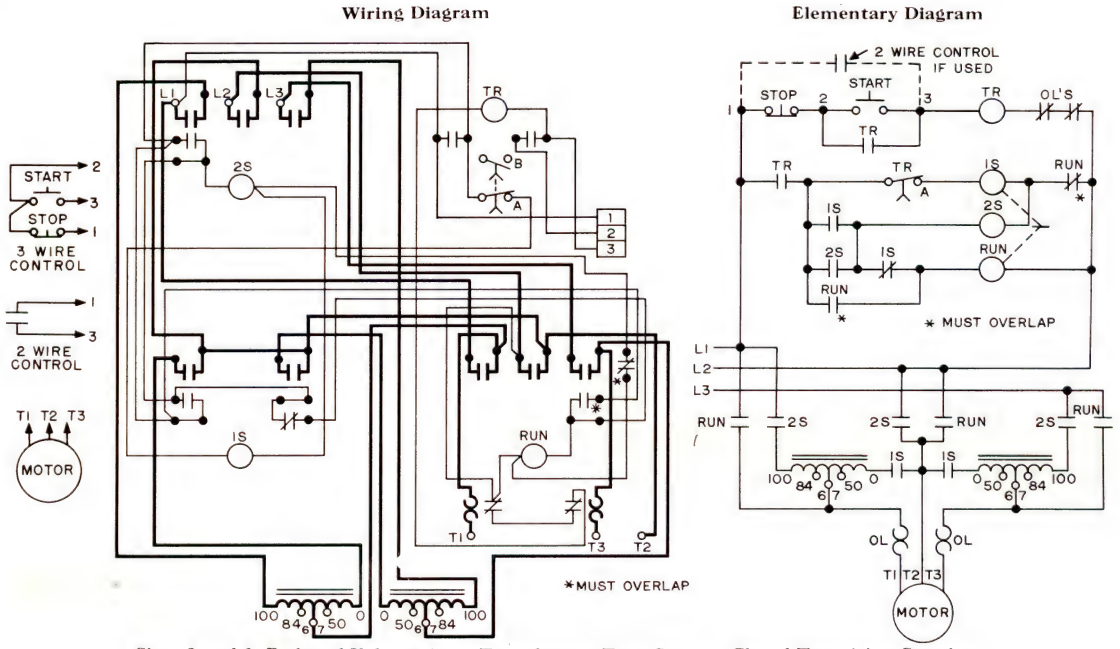


Size 5, 3 Phase, Primary Resistor Type Starters

CLASS 8606
AC REDUCED VOLTAGE STARTERS — AUTO-TRANSFORMER TYPE

SIZES 2 AND 3

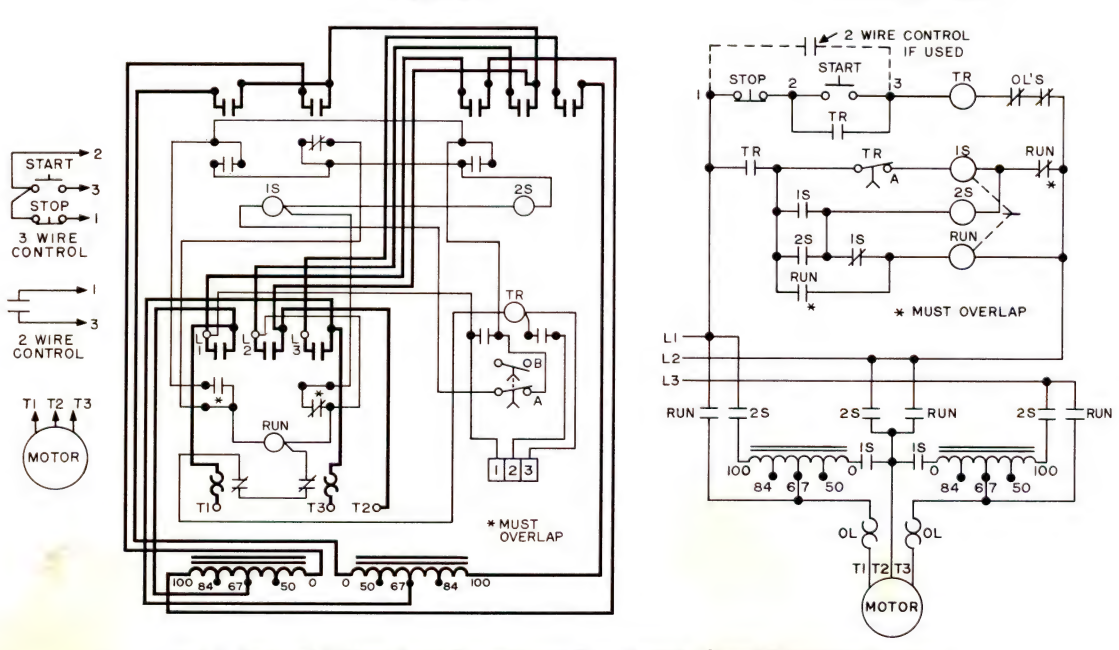
122



Sizes 2 and 3, Reduced Voltage Auto-Transformer Type Starter, Closed Transition Starting

SIZE 5

123



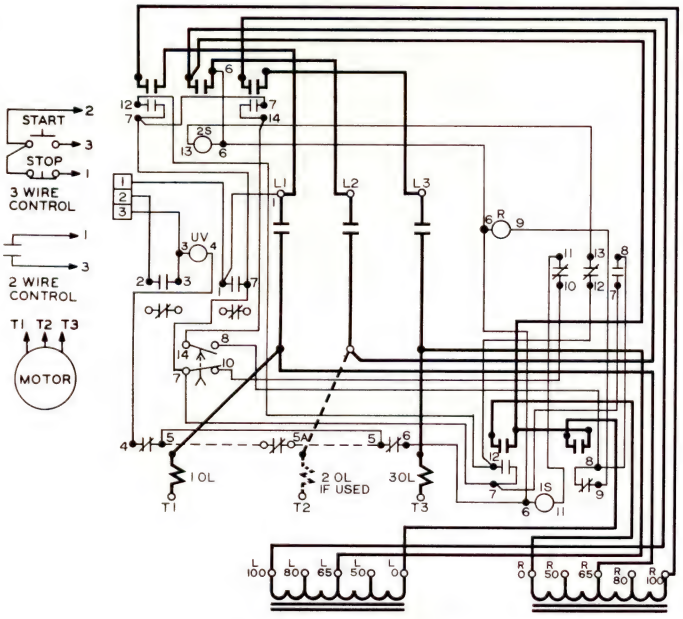
Size 5, Reduced Voltage Auto-Transformer Type Starter, Closed Transition Starting

CLASS 8606
AC REDUCED VOLTAGE STARTERS — AUTO-TRANSFORMER TYPE

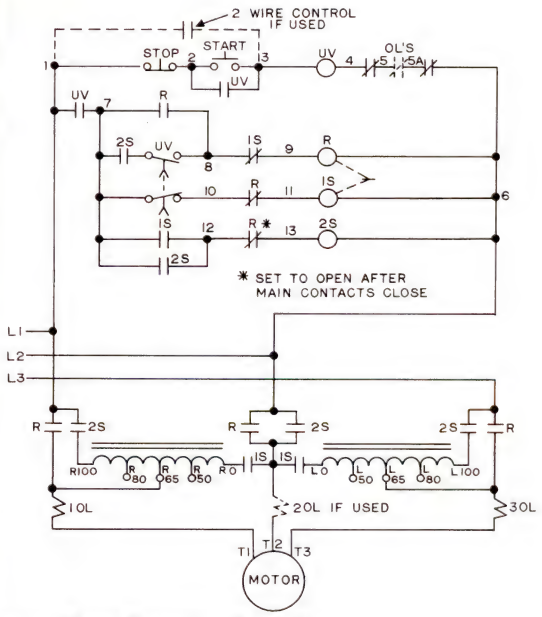
SIZES 6 AND 7

124

Wiring Diagram



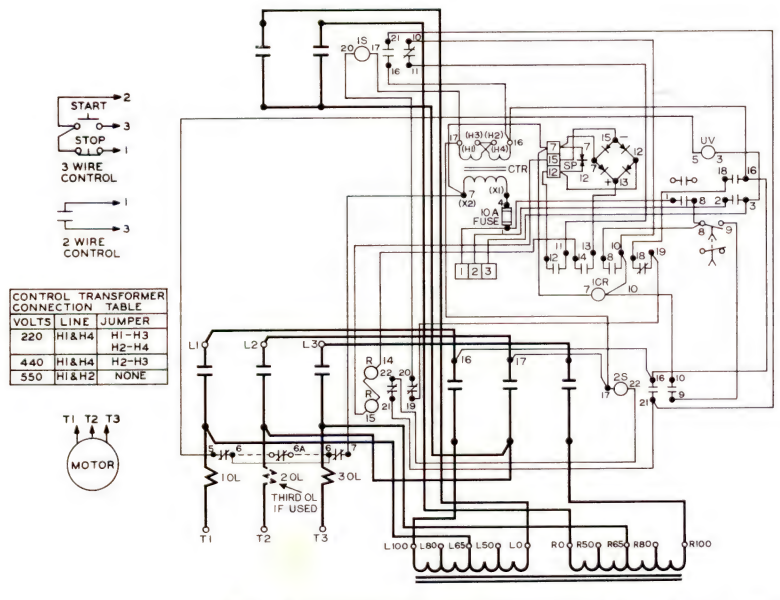
Elementary Diagram



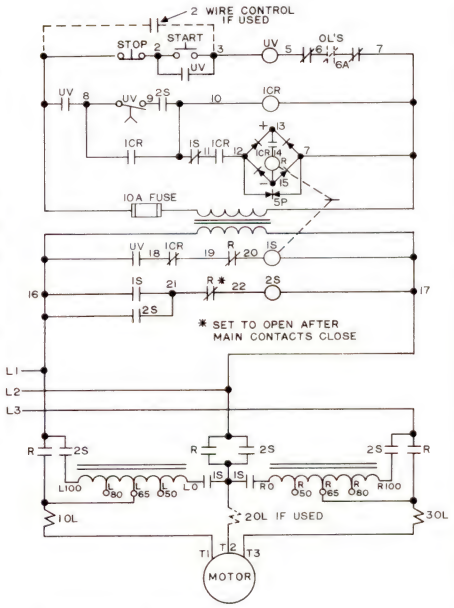
Size 6 Reduced Voltage Auto-Transformer Type Starter, Closed Transition Starting

125

Wiring Diagram



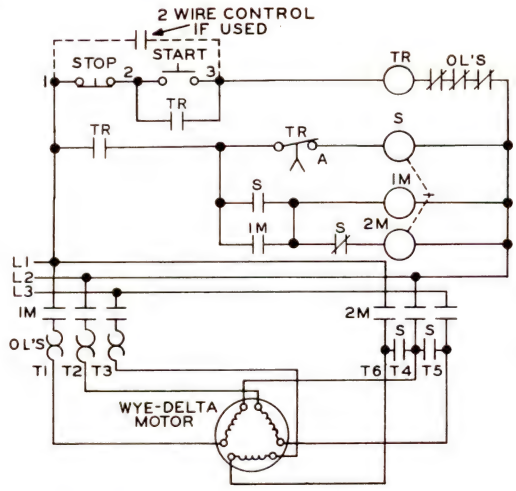
Elementary Diagram



Size 7 Reduced Voltage Auto-Transformer Type Starter, Closed Transition Starting

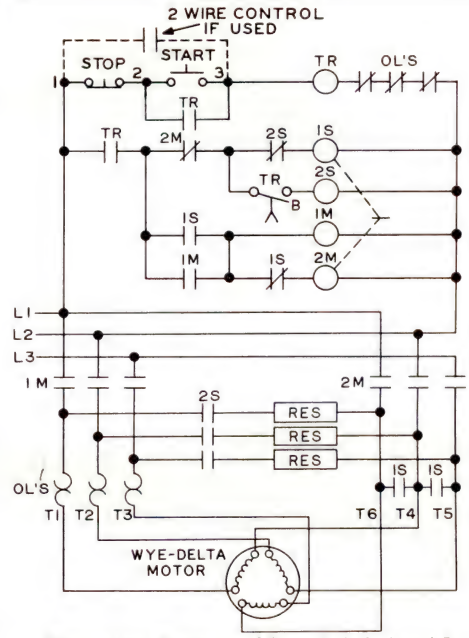
CLASS 8630
AC AUTOMATIC STARTERS FOR WYE-DELTA MOTORS

126



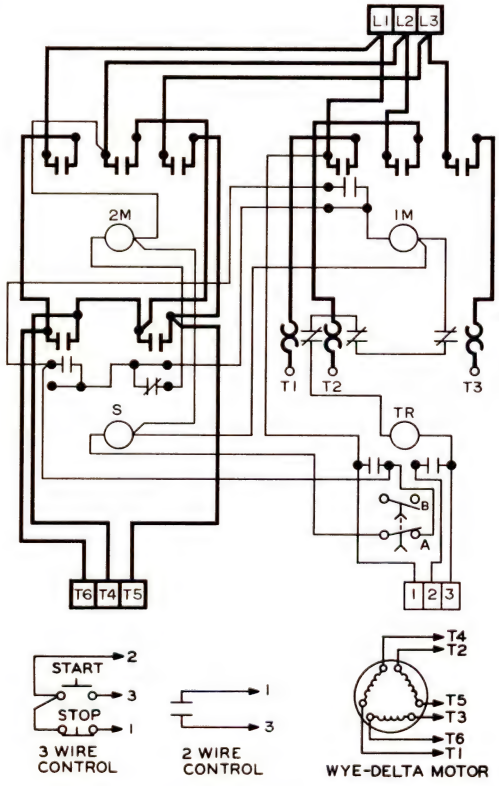
Elementary Diagram of Sizes 1, 2, 3, 4 and 5 Wye-Delta Starters with Open Transition Starting

127



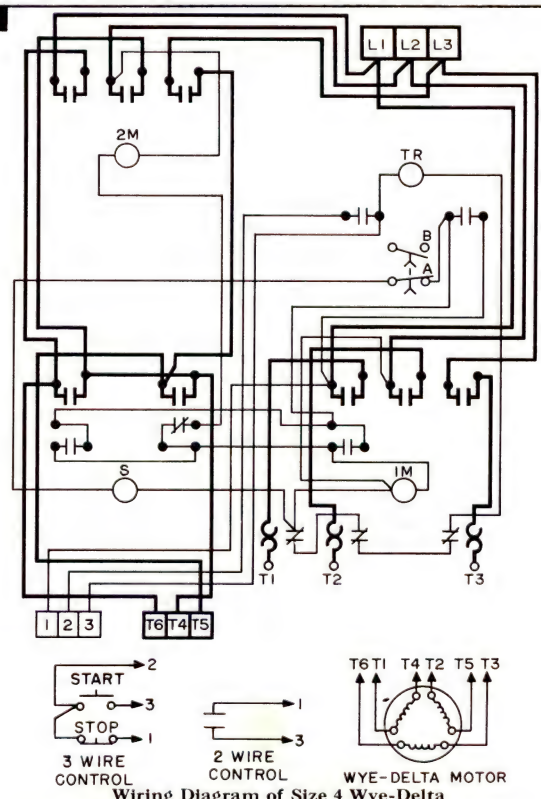
Elementary Diagram of Sizes 1, 2, 3, 4 and 5 Wye-Delta Starters with Closed Transition Starting

128



Wiring Diagram of Sizes 2 and 3 Wye-Delta Starter with Open Transition Starting

129

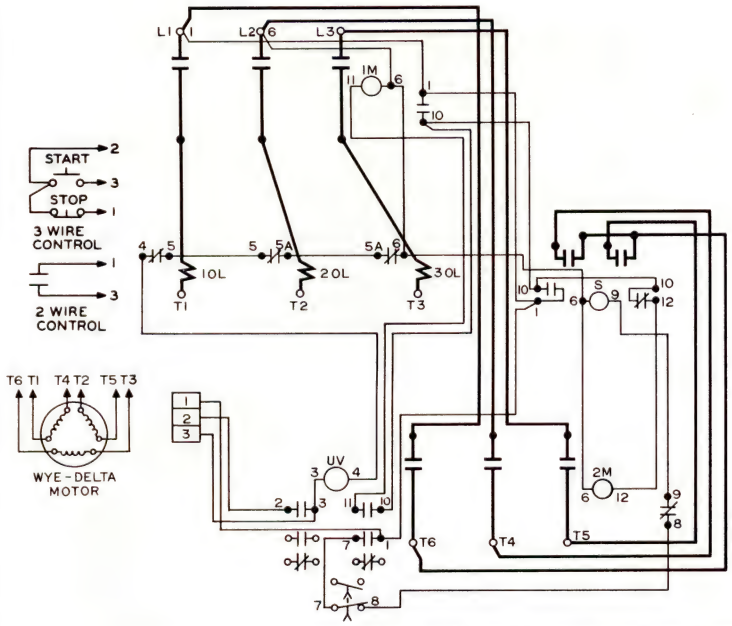


Wiring Diagram of Size 4 Wye-Delta Starters with Open Transition Starting

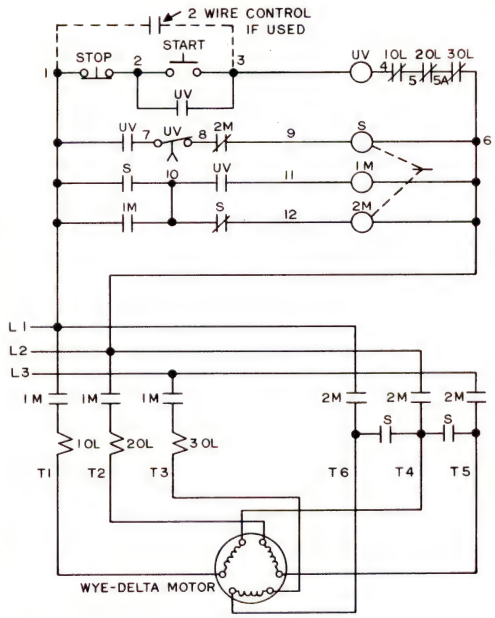
CLASS 8630
AC AUTOMATIC STARTERS FOR WYE-DELTA MOTORS

130

Wiring Diagram



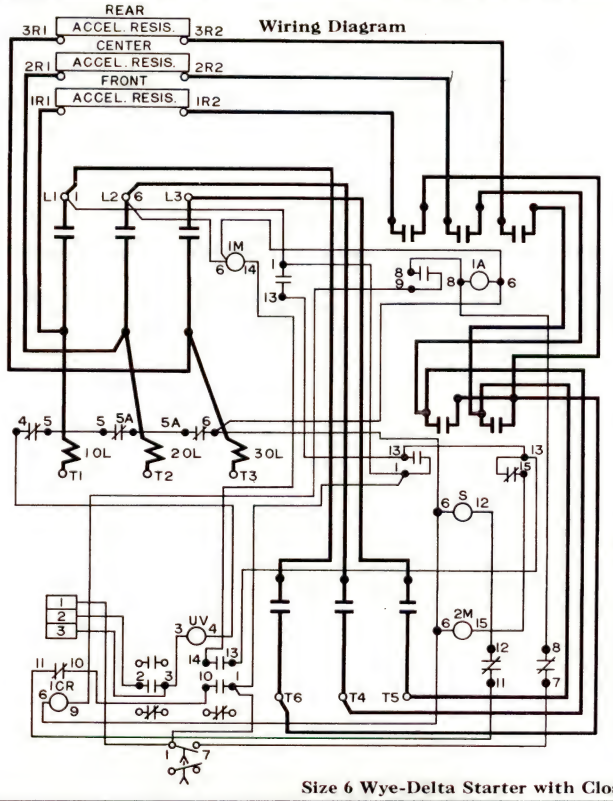
Elementary Diagram



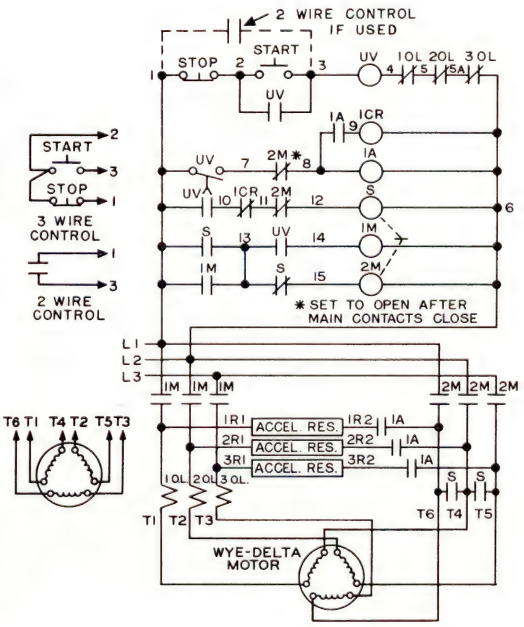
Size 6, Wye-Delta Starter with Open Transition Starting

131

Wiring Diagram



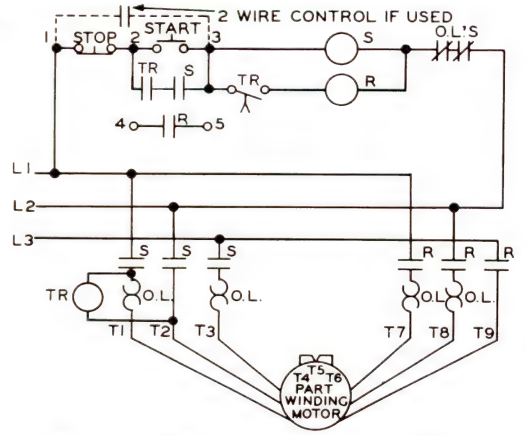
Elementary Diagram



Size 6 Wye-Delta Starter with Closed Transition Starting

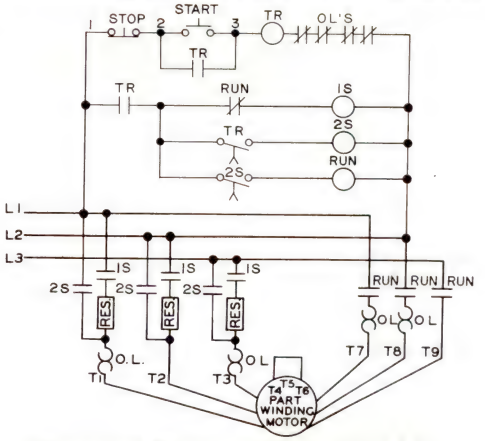
CLASS 8640
AC AUTOMATIC PART WINDING STARTERS

132



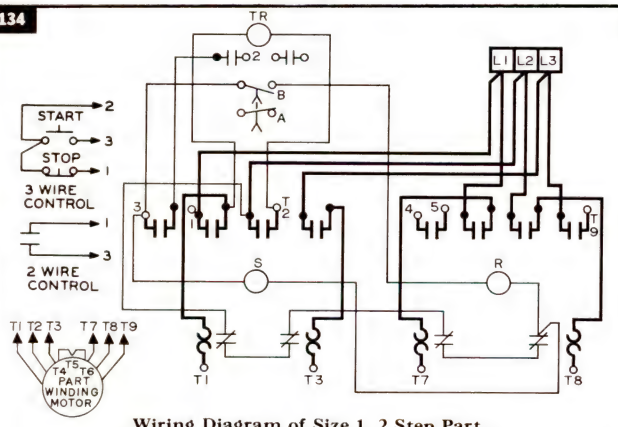
Elementary Diagram of Sizes 1, 2, 3, 4 & 5, 2 Step Part Winding Motor Starter

133



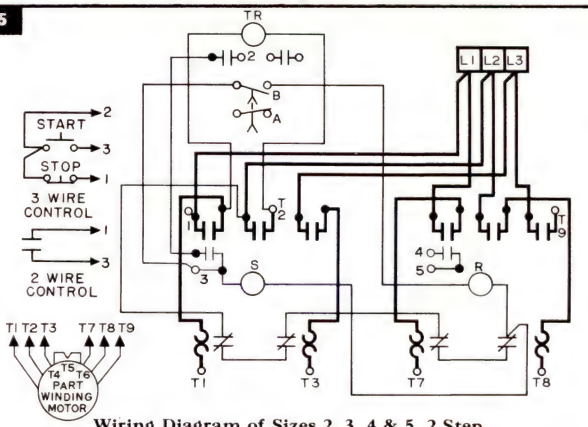
Elementary Diagram of Sizes 1, 2, 3, 4 & 5, 3 Step Part Winding Motor Starter

134



Wiring Diagram of Size 1, 2 Step Part Winding Motor Starter

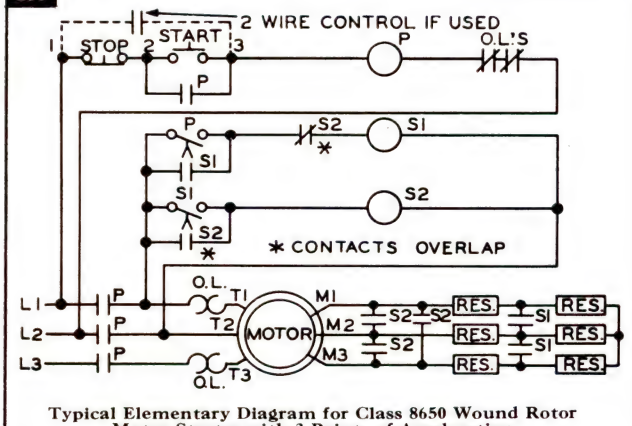
135



Wiring Diagram of Sizes 2, 3, 4 & 5, 2 Step Part Winding Motor Starter

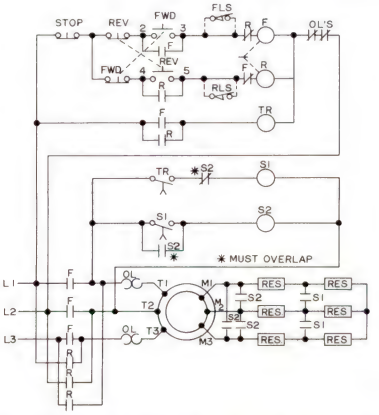
CLASS 8650, 8651 — AC REDUCED VOLTAGE STARTERS — SECONDARY RESISTOR TYPE

136



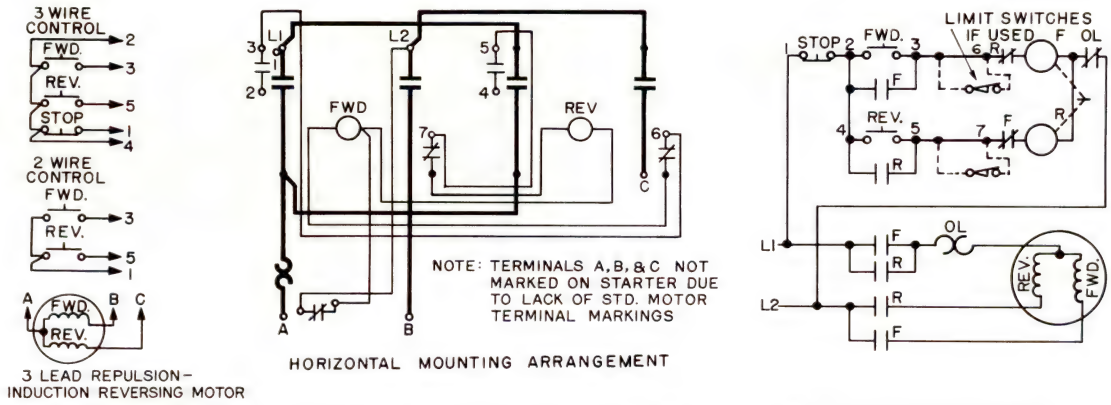
Typical Elementary Diagram for Class 8650 Wound Rotor Motor Starter with 3 Points of Acceleration

137



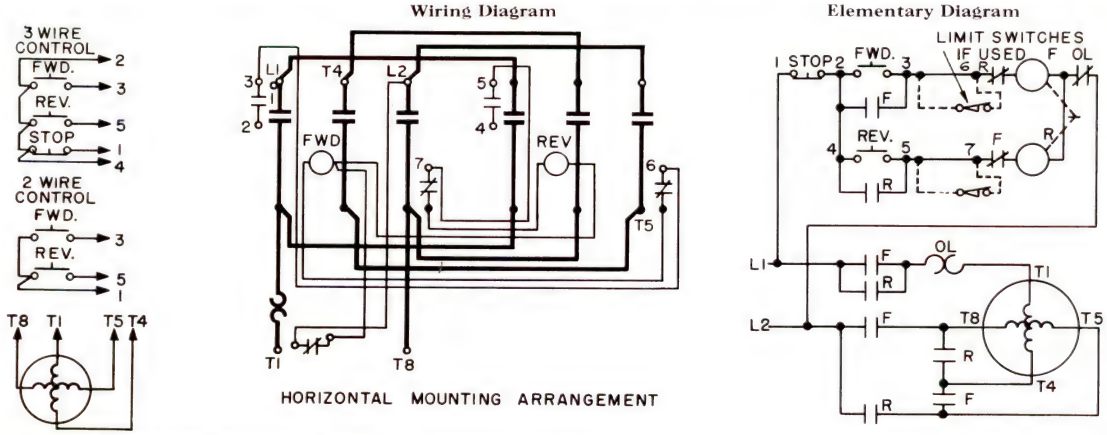
Typical Elementary Diagram for Class 8651 Reversing Wound Rotor Motor Starter with 3 Points of Acceleration

138



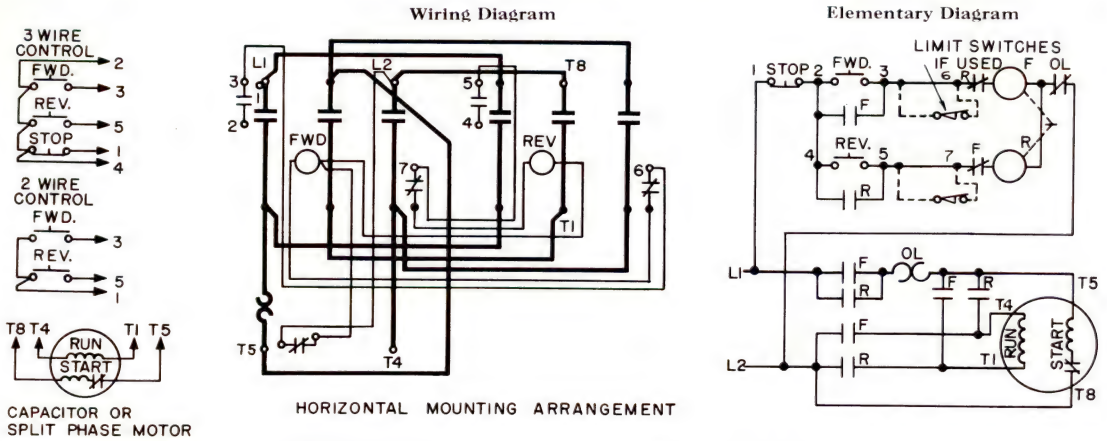
Type S, Sizes 0 and 1, 2 Pole Reversing Starters Used with Single Phase, 3 Lead Repulsion Induction Motors

139



Type S, Sizes 0 and 1, 3 Pole Reversing Starters Used with Single Phase, 4 Lead Repulsion-Induction Motors

140

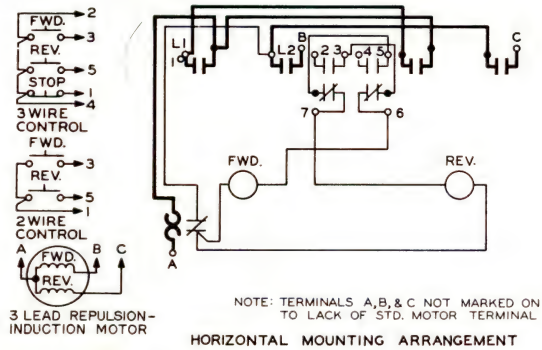


Type S, Sizes 0 and 1, 3 Pole Reversing Starters Used with Single Phase, 4 Lead Capacitor or Split Phase Motors

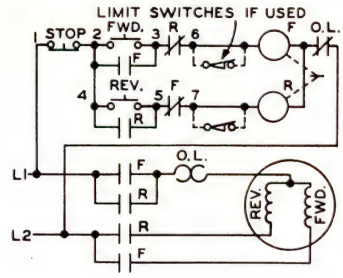
CLASS 8736
TYPES B & C AC REVERSING MAGNETIC STARTERS — SINGLE PHASE

141

Wiring Diagrams



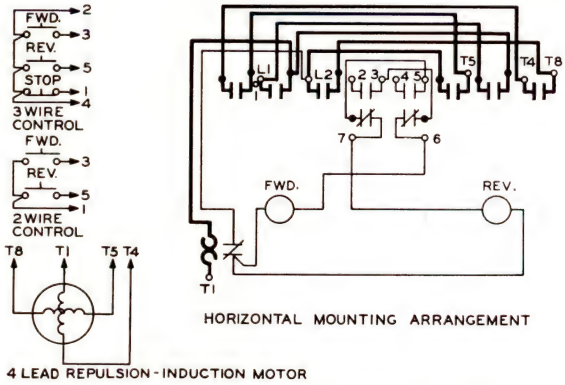
● Elementary Diagram



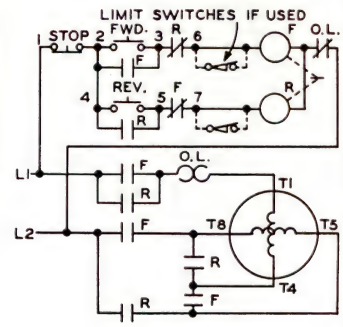
Sizes 0 and 1, 2 Pole Reversing Starters Used with Single Phase, 3 Lead Repulsion-Induction Motors

142

Wiring Diagrams



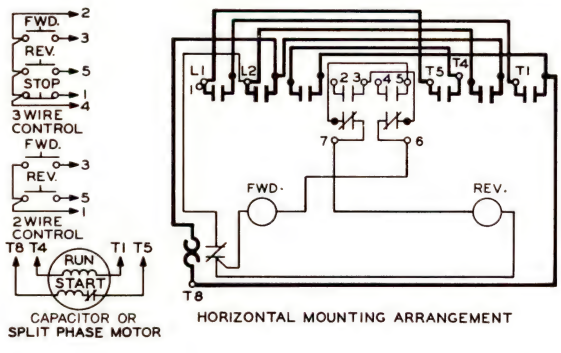
● Elementary Diagram



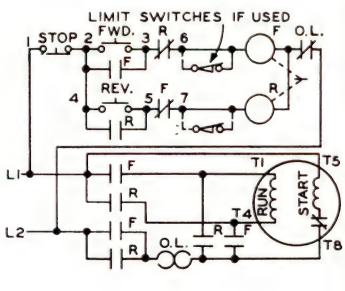
Size 0 and 1, 3 Pole Reversing Starters Used with Single Phase, 4 Lead Repulsion-Induction Motors

143

Wiring Diagrams



● Elementary Diagram

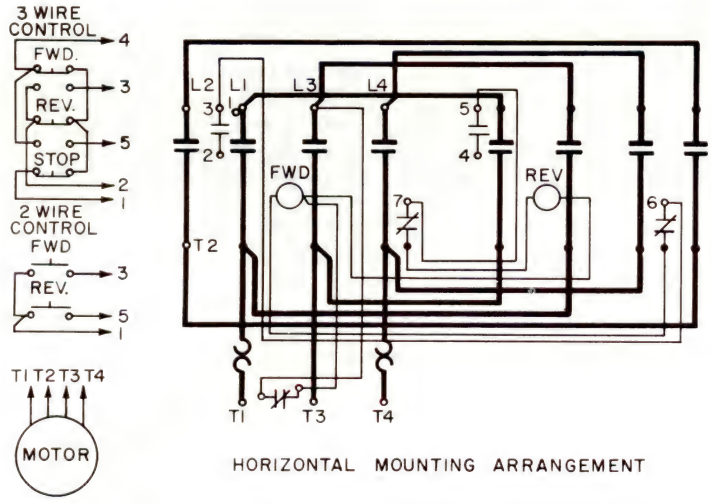


Size 0 and 1, 3 Pole Reversing Starters Used with Single Phase, 4 Lead Capacitor or Split Phase Motors

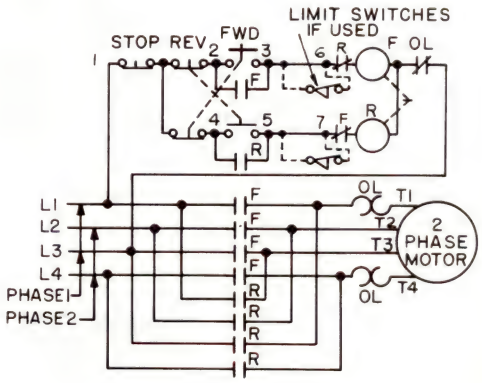
CLASS 8736
AC REVERSING MAGNETIC STARTERS — TWO PHASE

144

Wiring Diagram



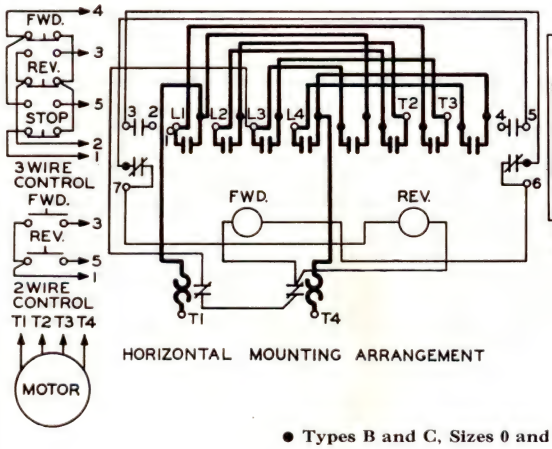
Elementary Diagram

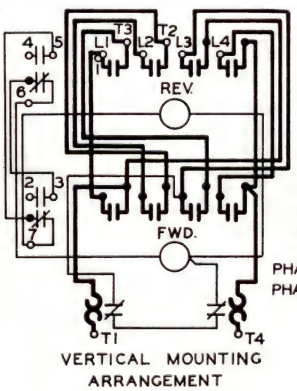


TYPE S Sizes 0, 1 and 2, 4 Pole, 2 Phase 4 Wire Reversing Starters

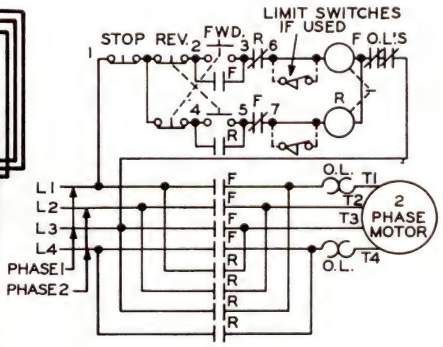
145

Wiring Diagrams





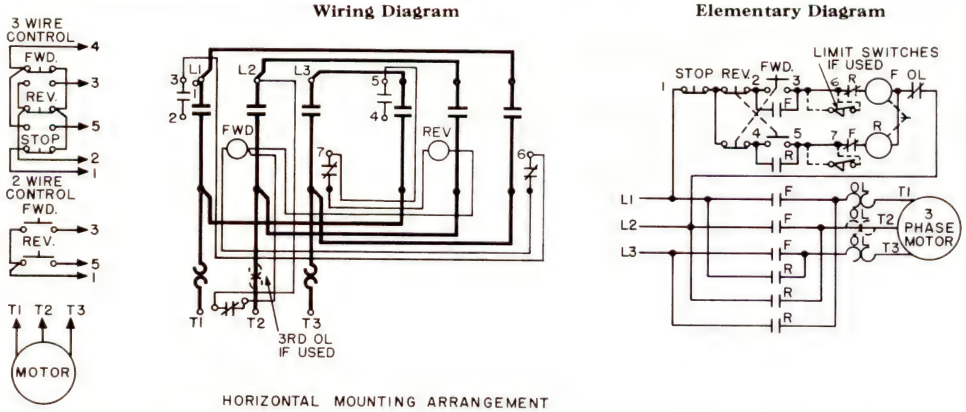
Elementary Diagram



● Types B and C, Sizes 0 and 1, 4 Pole, 2 Phase 4 Wire Reversing Starters

CLASS 8736
AC REVERSING MAGNETIC STARTERS — THREE PHASE

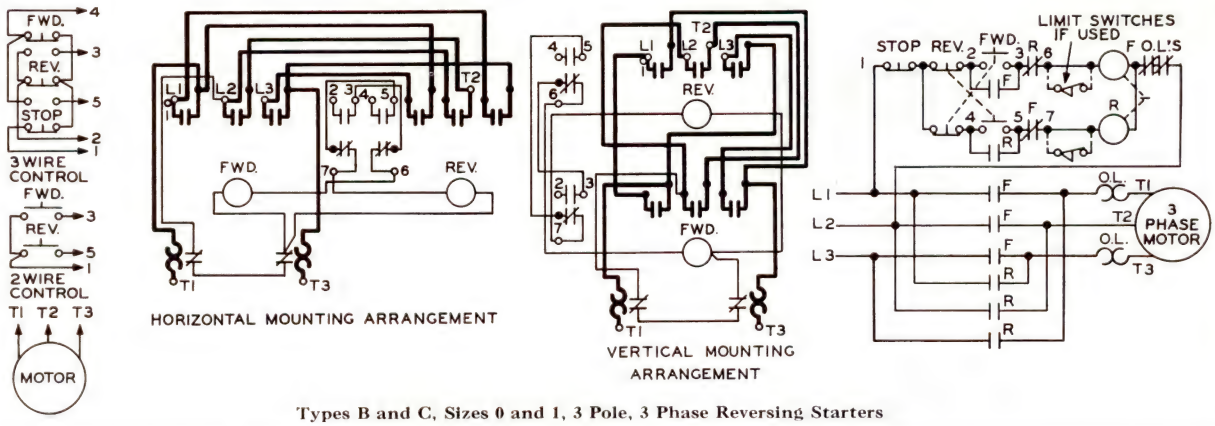
146



HORIZONTAL MOUNTING ARRANGEMENT

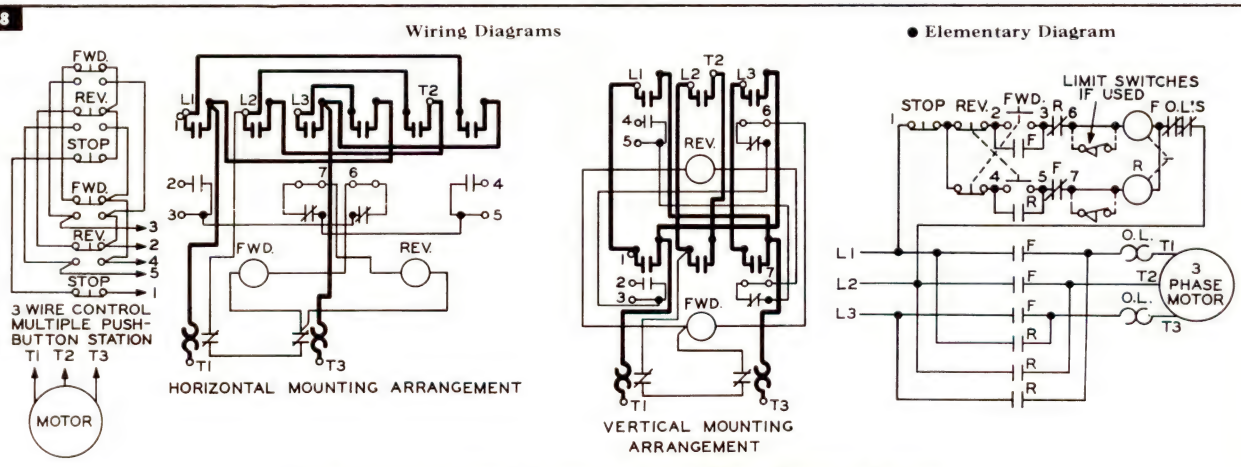
• **TYPE S** Sizes 0, 1 and 2, 3 Pole, 3 Phase Reversing Starters

147



Types B and C, Sizes 0 and 1, 3 Pole, 3 Phase Reversing Starters

148

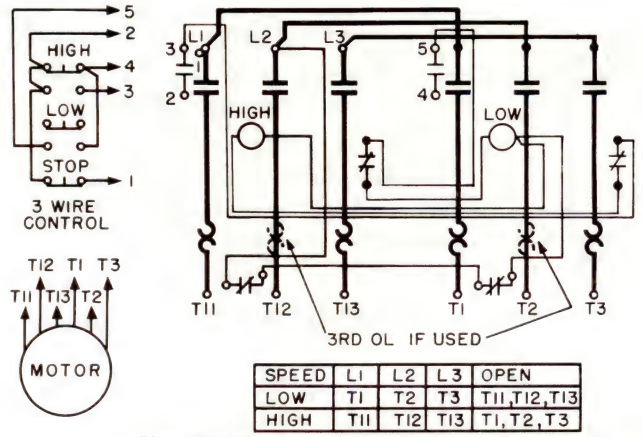


Types D thru G, Sizes 2, 3, 4 and 5, 3 Pole, 3 Phase Reversing Starters

• Revised — 12/67

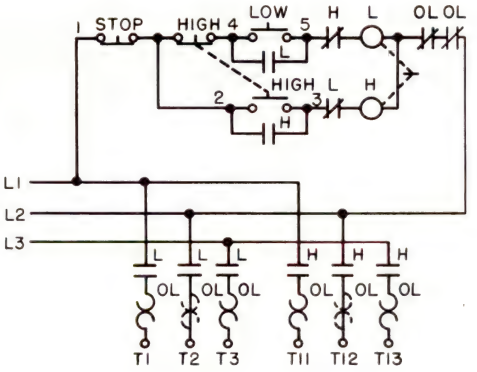
149

Wiring Diagram



SPEED	L1	L2	L3	OPEN
LOW	T1	T2	T3	T11,T12,T13
HIGH	T11	T12	T13	T1, T2, T3

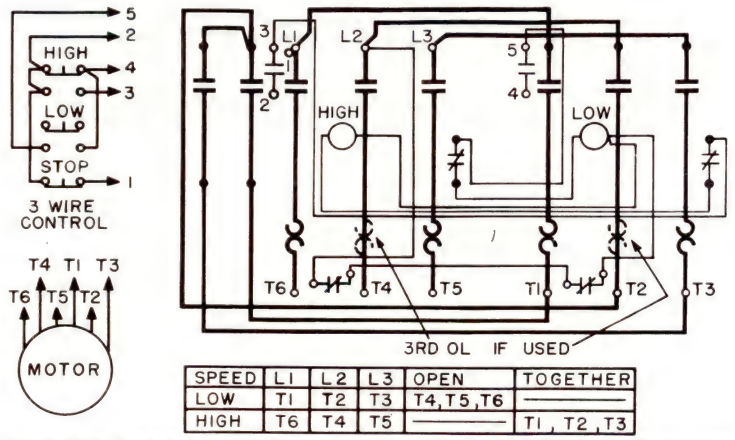
Elementary Diagram



Class 8810 Sizes 0, 1 and 2 Starters for Two Speed, Two Winding (Separate Winding), 3 Phase Motors

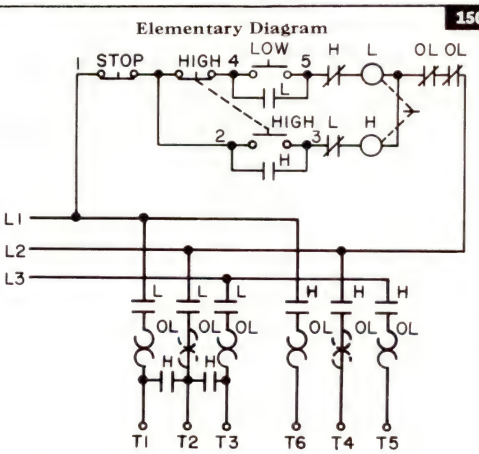
150

Wiring Diagram



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3	T4,T5,T6	
HIGH	T6	T4	T5		T1, T2, T3

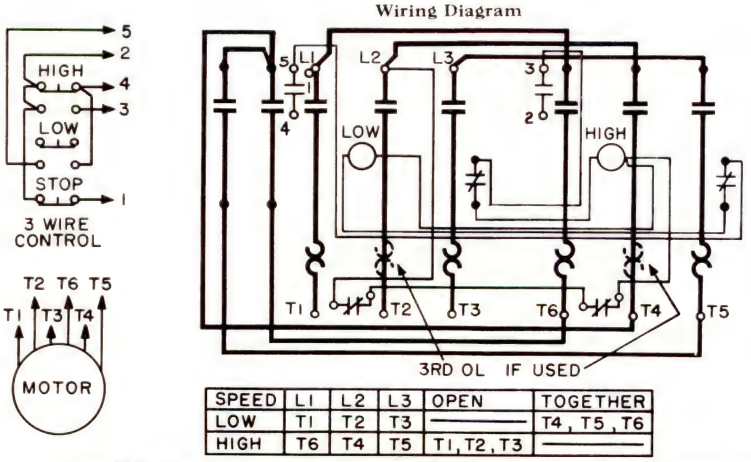
Elementary Diagram



Class 8810, Sizes 0, 1 and 2 Starters for Two Speed, One Winding, (Consequent Pole) Constant or Variable Torque, 3 Phase Motor

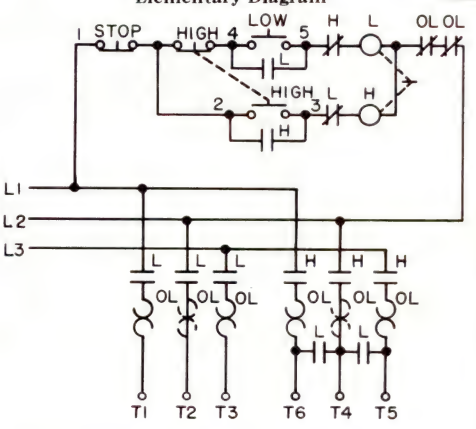
151

Wiring Diagram



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3		T4, T5, T6
HIGH	T6	T4	T5	T1, T2, T3	

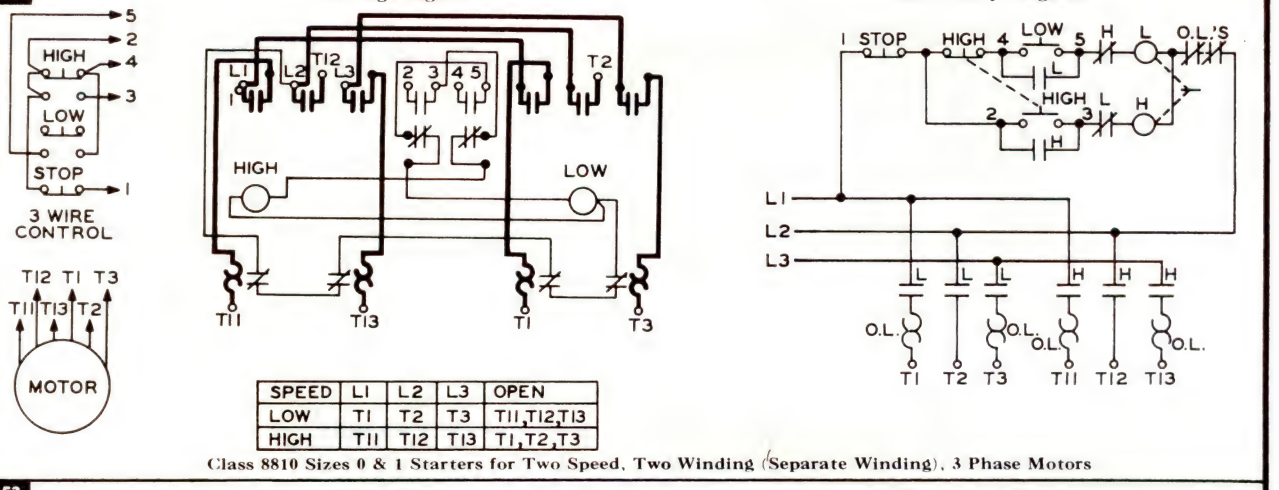
Elementary Diagram



Class 8810 Sizes 0, 1 and 2 Starters for Two Speed, One Winding (Consequent Pole) Constant Horsepower, 3 Phase Motor

CLASS 8810
TYPES B THRU G AC MULTISPEED STARTERS

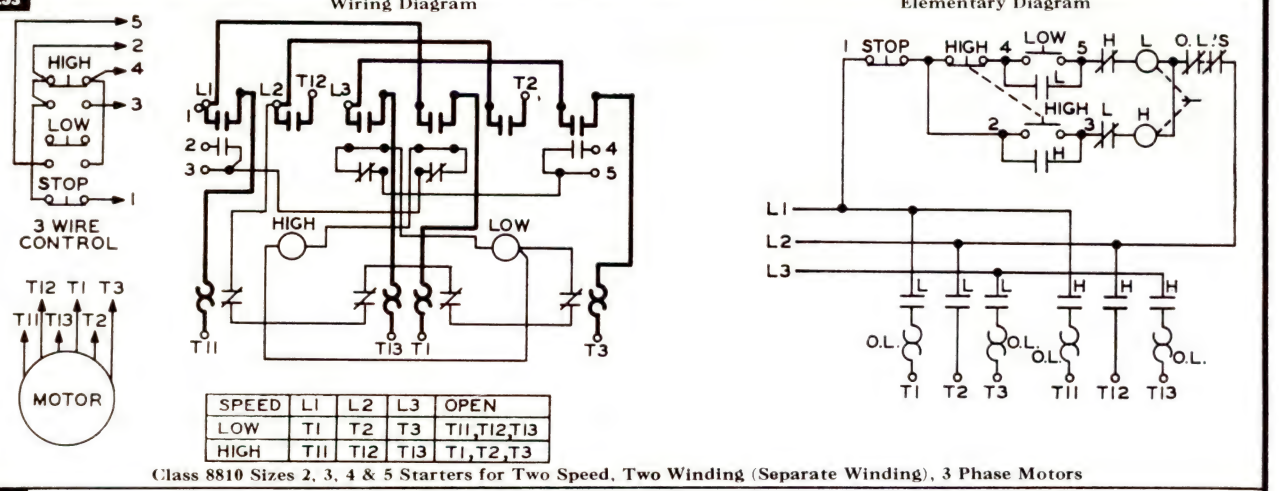
152



SPEED	L1	L2	L3	OPEN
LOW	T1	T2	T3	T11,T12,T13
HIGH	T11	T12	T13	T1,T2,T3

Class 8810 Sizes 0 & 1 Starters for Two Speed, Two Winding (Separate Winding), 3 Phase Motors

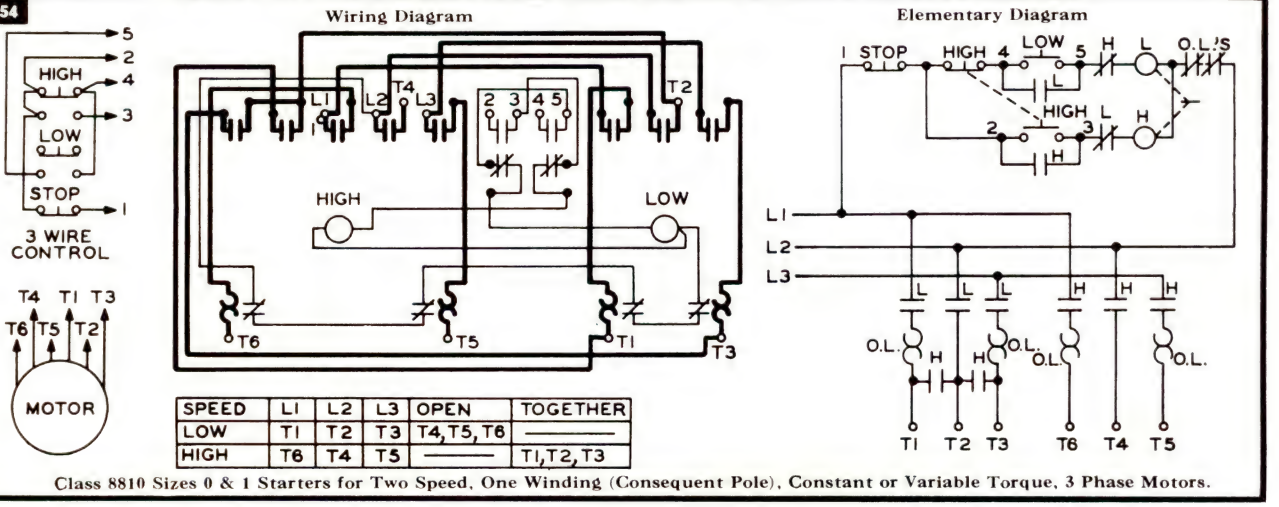
153



SPEED	L1	L2	L3	OPEN
LOW	T1	T2	T3	T11,T12,T13
HIGH	T11	T12	T13	T1,T2,T3

Class 8810 Sizes 2, 3, 4 & 5 Starters for Two Speed, Two Winding (Separate Winding), 3 Phase Motors

154



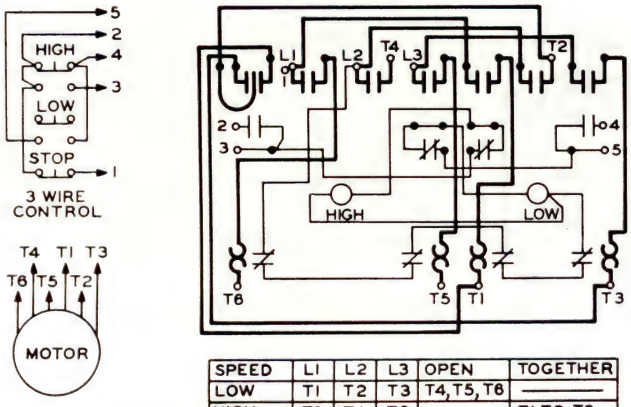
SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3	T4,T5,T6	——
HIGH	T6	T4	T5	——	T1,T2,T3

Class 8810 Sizes 0 & 1 Starters for Two Speed, One Winding (Consequent Pole), Constant or Variable Torque, 3 Phase Motors.

CLASS 8810
AC MULTISPEED STARTERS — TYPES B THRU G
(Cont'd)

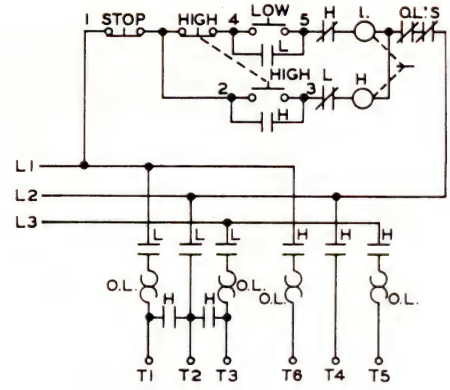
155

Wiring Diagram



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3	T4,T5,T6	——
HIGH	T6	T4	T5	——	T1,T2,T3

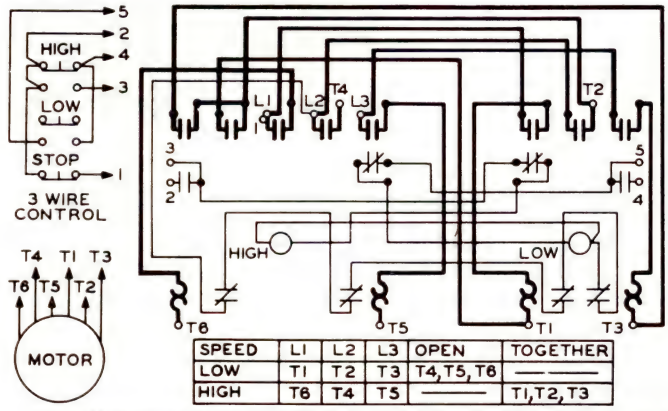
Elementary Diagram



Class 8810 Sizes 2 & 3 Starters for Two Speed, One Winding, (Consequent Pole) Constant or Variable Torque, 3 Phase Motor

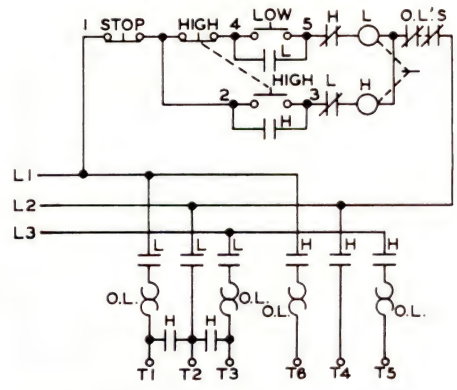
156

Wiring Diagram



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3	T4,T5,T6	——
HIGH	T6	T4	T5	——	T1,T2,T3

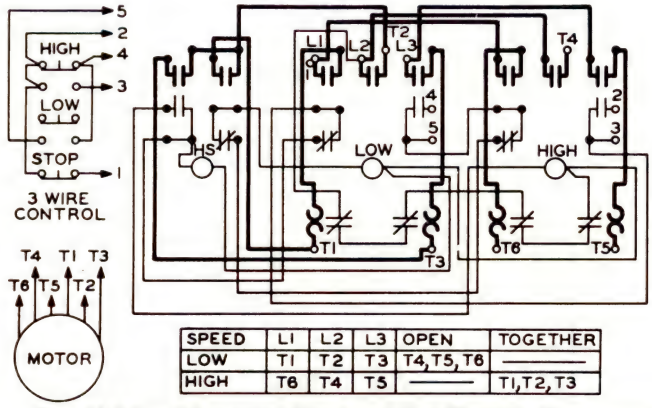
Elementary Diagram



Class 8810 Size 4 Starter for Two Speed, One Winding, (Consequent Pole) Constant or Variable Torque, 3 Phase Motor

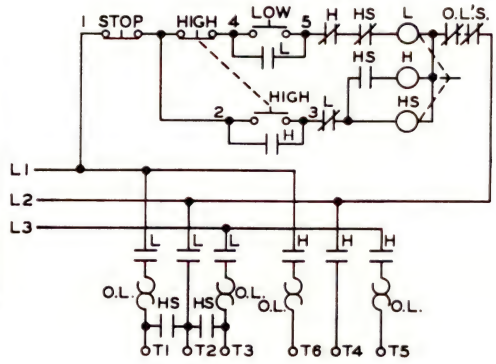
157

Wiring Diagram



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3	T4,T5,T6	——
HIGH	T6	T4	T5	——	T1,T2,T3

Elementary Diagram

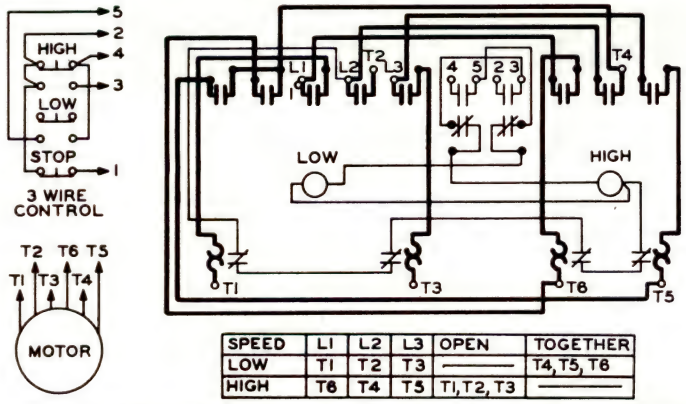


Class 8810 Size 5 Starter for Two Speed, One Winding, (Consequent Pole) Constant or Variable Torque, 3 Phase Motor

CLASSES 8810, 8811
TYPES B THRU G AC MULTISPEED STARTERS (Cont'd)

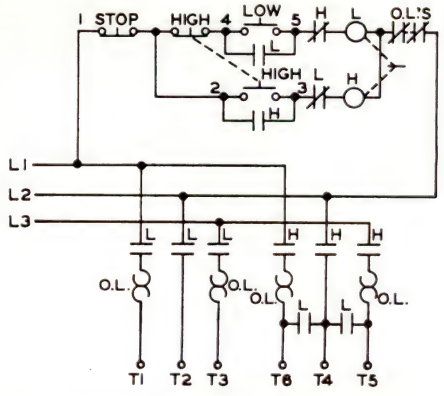
158

Wiring Diagram



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3	——	T4, T5, T6
HIGH	T6	T4	T5	T1, T2, T3	——

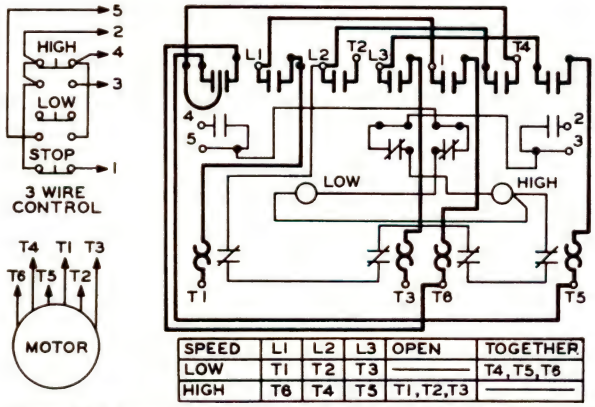
Elementary Diagram



Class 8810 Sizes 0 & 1 Starters for Two Speed, One Winding, (Consequent Pole) Constant Horsepower, 3 Phase Motor

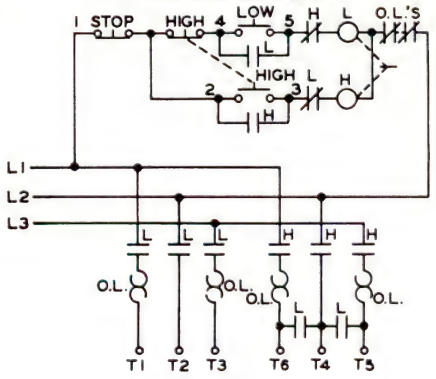
159

Wiring Diagram



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3	——	T4, T5, T6
HIGH	T6	T4	T5	T1, T2, T3	——

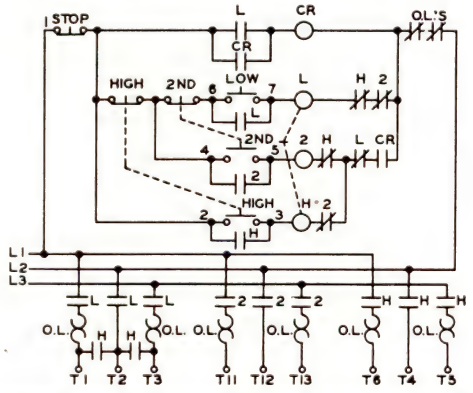
Elementary Diagram



Class 8810 Sizes 2 & 3 Starters for Two Speed, One Winding, (Consequent Pole) Constant Horsepower, 3 Phase Motor

160

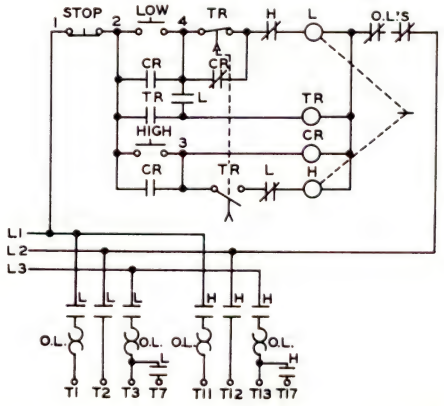
Elementary Diagram



Class 8811 Starter with Compelling Relay (Form R1)
For Three Speed, Two Winding (Consequent Pole)
Variable Torque, 3 Phase Motor

161

Elementary Diagram



Class 8810 Starter with Accelerating Relay (Form R2)
For Two Speed, Two Winding, Delta Connected 3 Phase Motor

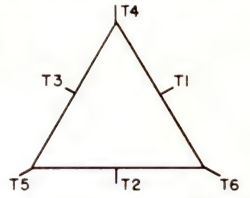
MULTISPEED MOTOR CONNECTIONS

NOTE: THE FOLLOWING DIAGRAMS ARE TYPICAL MOTOR CONNECTION ARRANGEMENTS, CONFORMING TO NEMA AND ASA STANDARDS. NOT ALL POSSIBLE ARRANGEMENTS ARE SHOWN.

162

3 PHASE 2 SPEED — 1 WINDING CONSTANT HORSEPOWER

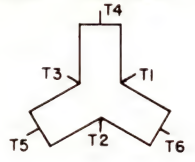
1



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3	——	T4, T5, T6
HIGH	T6	T4	T5	ALL OTHERS	——

3 PHASE 2 SPEED — 1 WINDING CONSTANT TORQUE

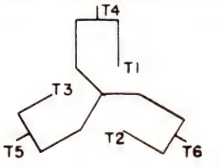
2



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3	ALL OTHERS	——
HIGH	T6	T4	T5	——	T1, T2, T3

3 PHASE 2 SPEED — 1 WINDING VARIABLE TORQUE

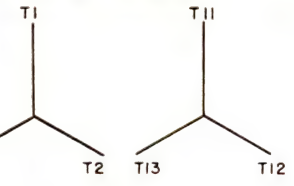
3



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3	ALL OTHERS	——
HIGH	T6	T4	T5	——	T1, T2, T3

3 PHASE 2 SPEED — SEPARATE WINDING

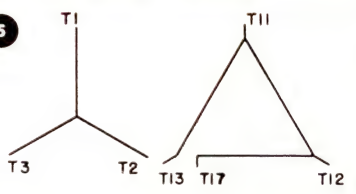
4



SPEED	L1	L2	L3	OPEN
LOW	T1	T2	T3	ALL OTHERS
HIGH	T11	T12	T13	ALL OTHERS

3 PHASE 2 SPEED — SEPARATE WINDING

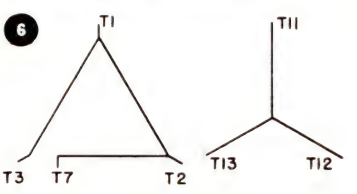
5



SPEED	L1	L2	L3	OPEN
LOW	T1	T2	T3	ALL OTHERS
HIGH	T11	T12	T13, T17	ALL OTHERS

3 PHASE 2 SPEED — SEPARATE WINDING

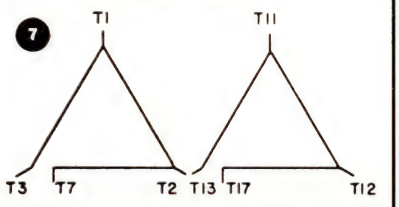
6



SPEED	L1	L2	L3	OPEN
LOW	T1	T2	T3, T7	ALL OTHERS
HIGH	T11	T12	T13	ALL OTHERS

3 PHASE 2 SPEED — SEPARATE WINDING

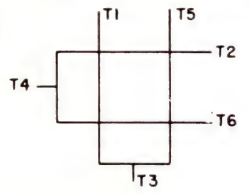
7



SPEED	L1	L2	L3	OPEN
LOW	T1	T2	T3, T7	ALL OTHERS
HIGH	T11	T12	T13, T17	ALL OTHERS

2 PHASE 2 SPEED — 1 WINDING VARIABLE TORQUE

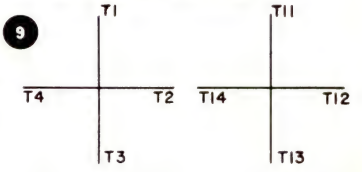
8



SPEED	L1	L3	L2	L4	OPEN
LOW	T1	T5	T2	T6	T3, T4
HIGH	T1, T5	T3	T2, T6	T4	——

2 PHASE 2 SPEED — SEPARATE WINDING

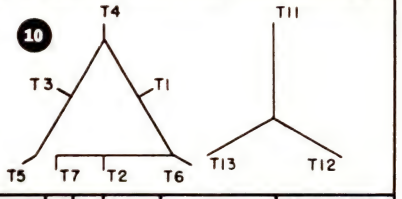
9



SPEED	L1	L3	L2	L4	OPEN
LOW	T1	T3	T2	T4	ALL OTHERS
HIGH	T11	T13	T12	T14	ALL OTHERS

3 PHASE 3 SPEED — 2 WINDING CONSTANT HORSEPOWER

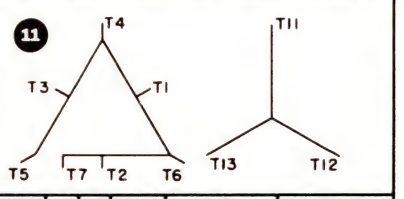
10



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3	ALL OTHERS	T4, T5, T6, T7
2ND	T6	T4	T5, T7	ALL OTHERS	——
HIGH	T11	T12	T13	ALL OTHERS	——

3 PHASE 3 SPEED — 2 WINDING CONSTANT HORSEPOWER

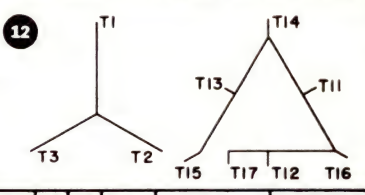
11



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3	ALL OTHERS	T4, T5, T6, T7
2ND	T11	T12	T13	ALL OTHERS	——
HIGH	T6	T4	T5, T7	ALL OTHERS	——

3 PHASE 3 SPEED — 2 WINDING CONSTANT HORSEPOWER

12



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3	ALL OTHERS	——
2ND	T11	T12	T13	ALL OTHERS	T14, T15, T16, T17
HIGH	T16	T14	T15, T17	ALL OTHERS	——

1748-B21

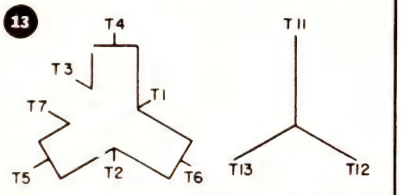
MULTISPEED MOTOR CONNECTIONS

163

NOTE: THE FOLLOWING DIAGRAMS ARE TYPICAL MOTOR CONNECTION ARRANGEMENTS, CONFORMING TO NEMA AND ASA STANDARDS. NOT ALL POSSIBLE ARRANGEMENTS ARE SHOWN.

3 PHASE 3 SPEED 2 WINDING CONSTANT TORQUE

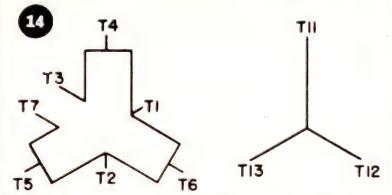
13



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3,T7	ALL OTHERS	—
2ND	T6	T4	T5	ALL OTHERS	T1,T2,T3,T7
HIGH	T11	T12	T13	ALL OTHERS	—

3 PHASE 3 SPEED 2 WINDING CONSTANT TORQUE

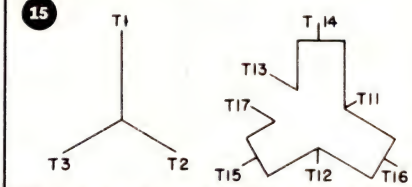
14



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3,T7	ALL OTHERS	—
2ND	T11	T12	T13	ALL OTHERS	—
HIGH	T6	T4	T5	ALL OTHERS	T1,T2,T3,T7

3 PHASE 3 SPEED 2 WINDING CONSTANT TORQUE

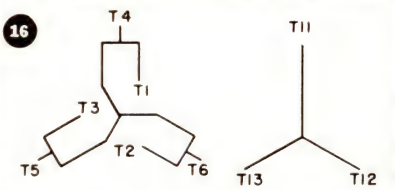
15



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3	ALL OTHERS	—
2ND	T11	T12	T13,T17	ALL OTHERS	—
HIGH	T16	T14	T15	ALL OTHERS	T11,T12,T13,T17

3 PHASE 3 SPEED 2 WINDING VARIABLE TORQUE

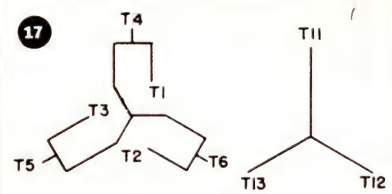
16



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3	ALL OTHERS	—
2ND	T6	T4	T5	ALL OTHERS	T1, T2, T3
HIGH	T11	T12	T13	ALL OTHERS	—

3 PHASE 3 SPEED 2 WINDING VARIABLE TORQUE

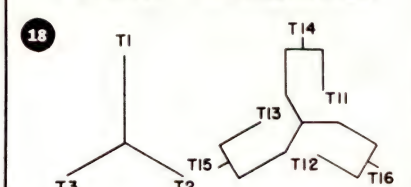
17



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3	ALL OTHERS	—
2ND	T11	T12	T13	ALL OTHERS	—
HIGH	T6	T4	T5	ALL OTHERS	T1, T2, T3

3 PHASE 3 SPEED 2 WINDING VARIABLE TORQUE

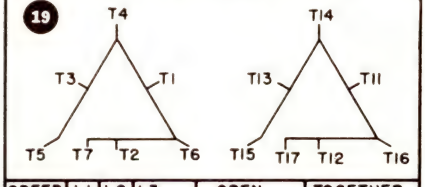
18



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3	ALL OTHERS	—
2ND	T11	T12	T13	ALL OTHERS	—
HIGH	T16	T14	T15	ALL OTHERS	T11, T12, T13

3 PHASE 4 SPEED 2 WINDING CONSTANT HORSEPOWER

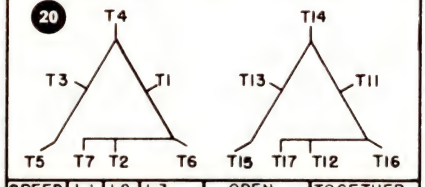
19



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3	ALL OTHERS	T4,T5,T6,T7
2ND	T6	T4	T5,T7	ALL OTHERS	—
3RD	T11	T12	T13	ALL OTHERS	T14,T15,T16,T17
HIGH	T16	T14	T15,T17	ALL OTHERS	—

3 PHASE 4 SPEED 2 WINDING CONSTANT HORSEPOWER

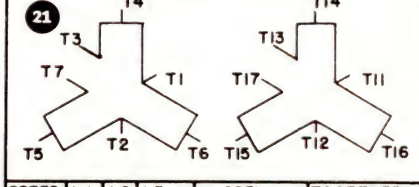
20



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3	ALL OTHERS	T4,T5,T6,T7
2ND	T11	T12	T13	ALL OTHERS	T14,T15,T16,T17
3RD	T6	T4	T5,T7	ALL OTHERS	—
HIGH	T16	T14	T15,T17	ALL OTHERS	—

3PHASE 4 SPEED 2 WINDING CONSTANT TORQUE

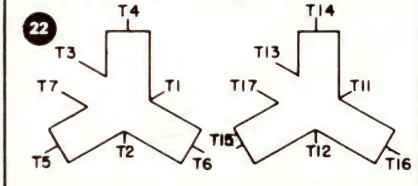
21



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3,T7	ALL OTHERS	—
2ND	T6	T4	T5	ALL OTHERS	T1,T2,T3,T7
3RD	T11	T12	T13,T17	ALL OTHERS	—
HIGH	T16	T14	T15	ALL OTHERS	T11,T12,T13,T17

3 PHASE 4 SPEED 2 WINDING CONSTANT TORQUE

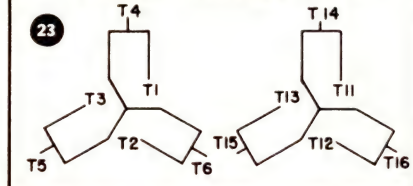
22



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3,T7	ALL OTHERS	—
2ND	T11	T12	T13,T17	ALL OTHERS	—
3RD	T6	T4	T5	ALL OTHERS	T1, T2, T3,T7
HIGH	T16	T14	T15	ALL OTHERS	T11,T12,T13,T17

3 PHASE 4 SPEED 2 WINDING VARIABLE TORQUE

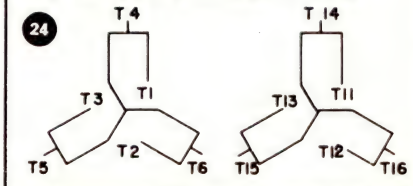
23



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3	ALL OTHERS	—
2ND	T6	T4	T5	ALL OTHERS	T1, T2, T3
3RD	T11	T12	T13	ALL OTHERS	—
HIGH	T16	T14	T15	ALL OTHERS	T11, T12, T13

3 PHASE 4 SPEED 2 WINDING VARIABLE TORQUE

24



SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3	ALL OTHERS	—
2ND	T11	T12	T13	ALL OTHERS	—
3RD	T6	T4	T5	ALL OTHERS	T1, T2, T3
HIGH	T16	T14	T15	ALL OTHERS	T11, T12, T13

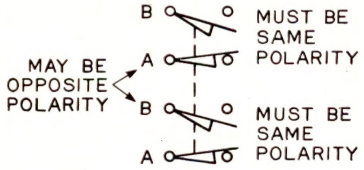
WIRING DIAGRAMS

CLASS 9007
LIMIT SWITCHES

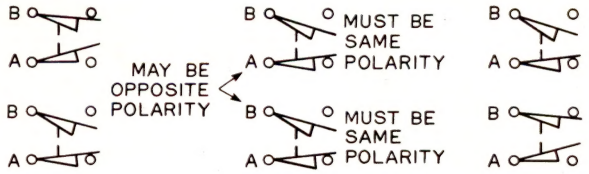
TYPE B

164 1 Pole

165 2 Pole

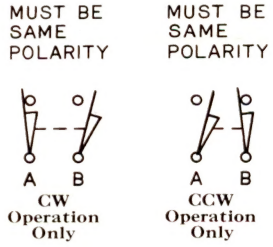


166 2 Pole Neutral Position

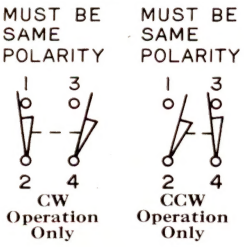


TYPE AW

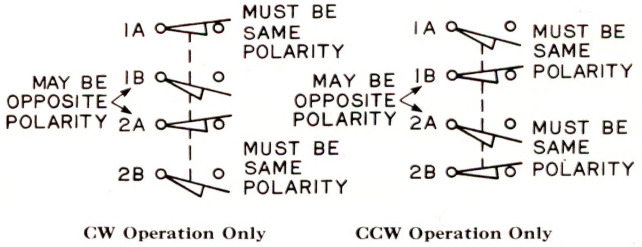
167 Types AW-12, AW-14



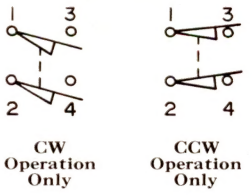
168 Type AW-16 with Lever Arm Opposite Conduit Hole *



169 Type AW-18

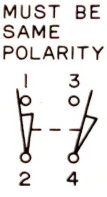


170 Type AW-19 with Lever Arm Opposite Conduit Hole *

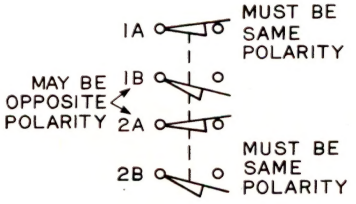


171 Types AW-32, 34, 42, 44

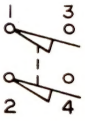
172 Types AW-36, AW-46



173 Types AW-38, AW-48



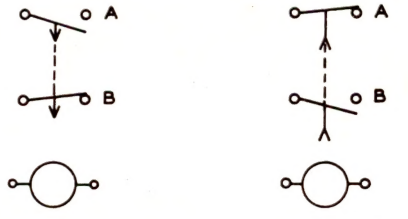
174 Types AW-39, AW-49



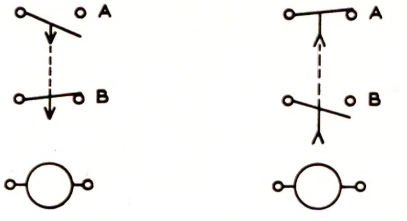
*If lever arm is placed at same end of box as conduit, then normally open contacts become normally closed and vice versa.

CLASS 9050
AC AND DC TIMING RELAYS (Cont'd)

175 AC PNEUMATIC TIMING RELAY — TYPE A



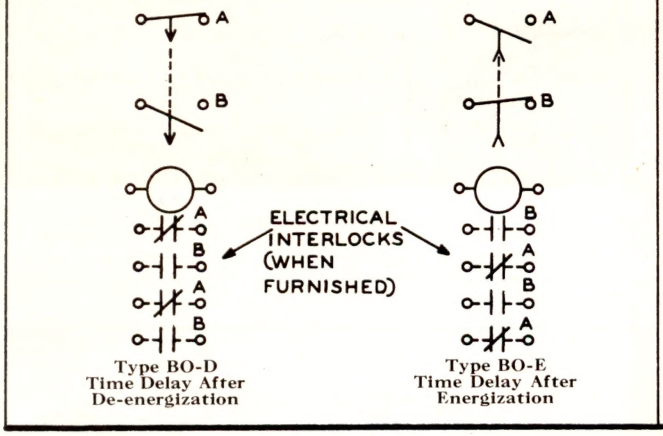
176 DC PNEUMATIC TIMING RELAY — TYPE H



CLASS 9050
AC AND DC TIMING RELAYS (Cont'd)

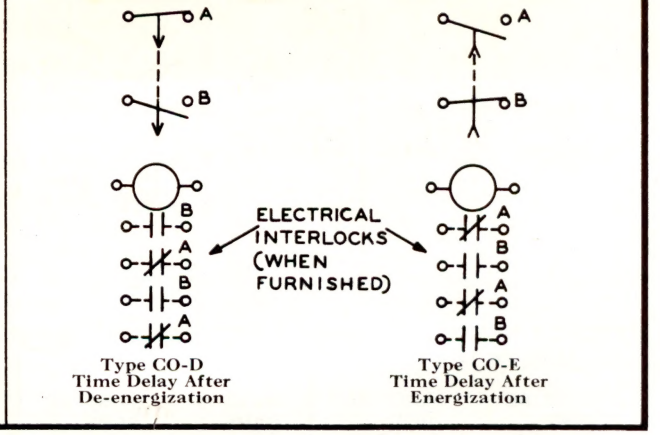
177

AC PNEUMATIC TIMING RELAY — TYPE B



178

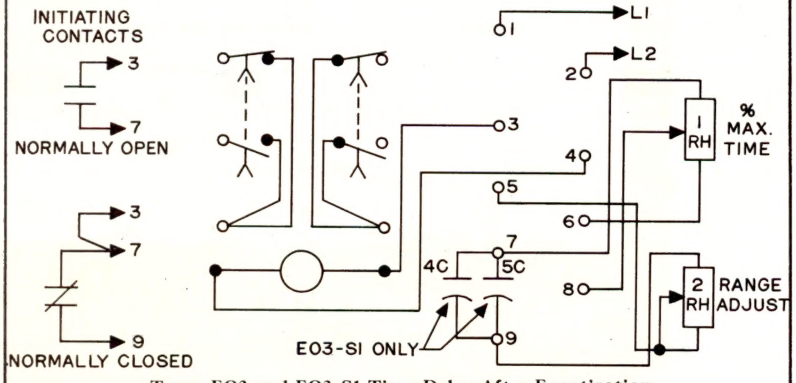
DC PNEUMATIC TIMING RELAY — TYPE C



CLASS 9050
SOLID STATE TIMING RELAYS

179

TYPE E TRANSISTORIZED TIMING RELAY

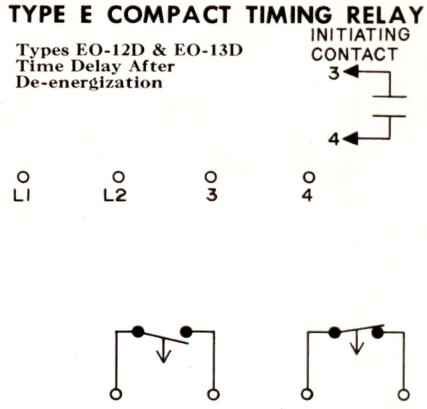


Types EO3 and EO3-S1 Time Delay After Energization

180

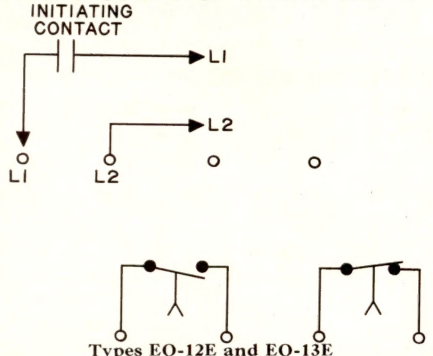
TYPE E COMPACT TIMING RELAY

Types EO-12D & EO-13D Time Delay After De-energization



181

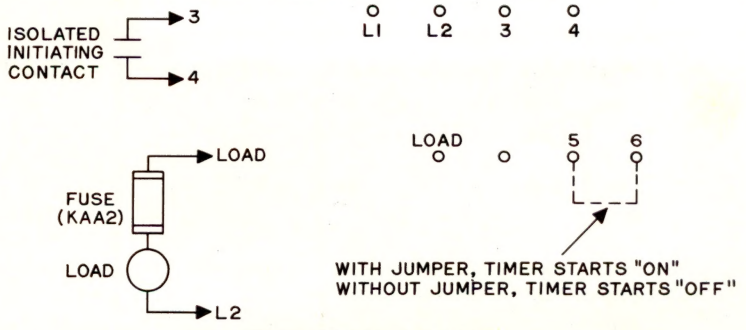
TYPE E COMPACT TIMING RELAY



Types EO-12E and EO-13E Time Delay After Energization

182

TYPE E SEQUENCE TIMING RELAY



Types EO-22 and EO-23

design leadership . . .

WIRE & CONDUIT TABLES

1965 N. E. C.

ALLOWABLE CURRENT-CARRYING CAPACITIES OF INSULATED CONDUCTORS IN AMPERES

Not More Than Three Conductors in Raceway or Cable
(Based on Room Temperature of 30° C., 86° F.)

Size AWG MCM	Table 310-12 Copper Conductors			Table 310-14 Aluminum Conductors		
	60° C	75° C	90° C	60° C	75° C	90° C
	Rubber Type R Type RW Type RU Type RUW (14-2) Thermo-plastic Type T Type TW	Rubber Type RH Type RUH (14-2) Type RHW Thermo-plastic Type THW	Thermo-plastic Asbestos Type TA, SA Var-Cam Type V Asbestos Var-Cam Type AVB	Rubber Type R RW, RU RUW (12-2) Thermo-plastic Type T Type TW	Rubber Type RH Type RUH (14-2) Type RHW Thermo-plastic Type THW	Thermo-plastic Asbestos Type TA, Var-Cam. Type V Asbestos Var-Cam. Type AVB
14	15	15	25	....	....	...
12	20	20	30	15	15	25
10	30	30	40	25	25	30
8	40	45	50	30	40	40
6	55	65	70	40	50	55
4	70	85	90	55	65	70
3	80	100	105	65	75	80
2	95	115	120	75	▲ 90	95
1	110	130	140	85	▲100	110
0	125	150	155	100	▲120	125
00	145	175	185	115	▲135	145
000	165	200	210	130	▲155	165
0000	195	230	235	155	▲180	185
250	215	255	270	170	205	215
300	240	285	300	190	230	240
350	260	310	325	210	250	260
400	280	335	360	225	270	290
500	320	380	405	260	310	330
600	355	420	455	285	340	370
700	385	460	490	310	375	395
750	400	475	500	320	385	405
800	410	490	515	330	395	415
900	435	520	555	355	425	455
1,000	455	545	585	375	445	480
1,250	495	590	645	405	485	530
1,500	520	625	700	435	520	580
1,750	545	650	735	455	545	615
2,000	560	665	775	470	560	650

CORRECTION FACTOR FOR ROOM TEMPERATURES OVER 30° C., 86° F.

°C °F.						
40 104	.82	.88	.90	.82	.88	.90
45 113	.71	.82	.85	.71	.82	.85
50 122	.58	.75	.80	.58	.75	.80
55 131	.41	.67	.74	.41	.67	.74
60 140	...	.58	.67	...	.58	.67
70 158	...	.35	.52	...	.35	.52
75 167	...	...	.43	...	...	.43
80 176	...	...	.30	...	...	.30

NUMBER OF CONDUCTORS IN CONDUIT OR TUBING

Rubber Covered, Types RF-2, RFH-2, R, RH, RHH, RHW, RW, RH-RW, RU, RUH, RUW, SF and SFF. Thermoplastic, Types TF, T, TW and TWH

One to Nine Conductors

For more than nine conductors, see Tables, Chapter 9.
(See Sections 300-18, 346-6, 348-6 — 1965 N. E. C.)

Based on Chapter 9 Table 1 — 1965 N. E. C.

Size AWG MCM	Number of Conductors in One Conduit or Tubing								
	1	2	3	4	5	6	7	8	9
18	½	½	½	½	½	½	½	¾	¾
16	½	½	½	½	½	½	¾	¾	¾
14	½	½	½	½	¾	¾	1	1	1
12	½	½	½	¾	¾	1	1	1	1¼
10	½	¾	¾	¾	1	1	1	1¼	1¼
8	½	¾	¾	1	1¼	1¼	1¼	1½	1½
6	½	1	1	1¼	1½	1½	2	2	2
4	½	1¼	*1¼	1½	1½	2	2	2	2½
3	¾	1¼	1¼	1½	2	2	2	2½	2½
2	¾	1¼	1¼	2	2	2	2½	2½	2½
1	¾	1½	1½	2	2½	2½	2½	3	3
0	1	1½	2	2	2½	2½	3	3	3
00	1	2	2	2½	2½	3	3	3	3½
000	1	2	2	2½	3	3	3	3½	3½
0000	1¼	2	2½	3	3	3	3½	3½	4
250	1¼	2½	2½	3	3	3½	4	4	5
300	1¼	2½	2½	3	3½	4	4	5	5
350	1¼	3	3	3½	3½	4	5	5	5
400	1½	3	3	3½	4	4	5	5	5
500	1½	3	3	3½	4	5	5	5	6
600	2	3½	3½	4	5	5	6	6	6
700	2	3½	3½	5	5	5	6	6	...
750	2	3½	3½	5	5	6	6	6	...
800	2	3½	4	5	5	6	6	...	...
900	2	4	4	5	6	6	6	...	...
1000	2	4	4	5	6	6	...	...	...
1250	2½	5	5	6	6	...	...	...	...
1500	3	5	5	6	...	...	...	...	...
1750	3	5	6	6	...	...	...	...	...
2000	3	6	6	...	...	...	...	...	...

See notes 8 and 11 for tables 310-12 and 310-14, for reduction factor for more than 3 conductors.

Lay-in Duct — No derating necessary up to 30 conductors and 20% fill — NEC 362-5 and 374-5.

*Where a service run of conduit or electrical metallic tubing does not exceed 50 feet in length and does not contain more than the equivalent of two quarter bends from end to end two No. 4 insulated and one No. 4 bare conductors may be installed in 1-inch conduit or tubing.

▲For three wire, single phase service and sub-service circuits, the allowable current-carrying capacity of RH, RH-RW, RHH, RHW and THW aluminum conductors shall be for Sizes #2-100 Amp., #1-110 Amp., #1/0-125 Amp., #2/0-150 Amp., #3/0-170 Amp. and #4/0-200 Amp.

NOTES TO TABLES 310-12 AND 310-14 — 1965 N. E. C.

8. **More Than Three Conductors in a Raceway or Cable.** Tables 310-12 and 310-14 give the allowable current carrying capacities for not more than three conductors in a raceway or cable. Where the number of conductors in a raceway or cable exceeds three, the allowable current-carrying capacity of each conductor shall be reduced as shown in the following Table:

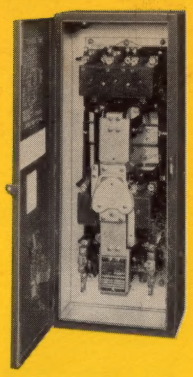
Number of Conductors	Per Cent of Values in Tables 310-12 and 310-14
4 to 6	80
7 to 24	70
25 to 42	60
43 and above	50

Exception — When conductors of different systems, as provided in Section 300-3, are installed in a common raceway the derating factors shown above apply to the number of Power and Lighting (Articles 210, 215, 220 and 230) conductors only.

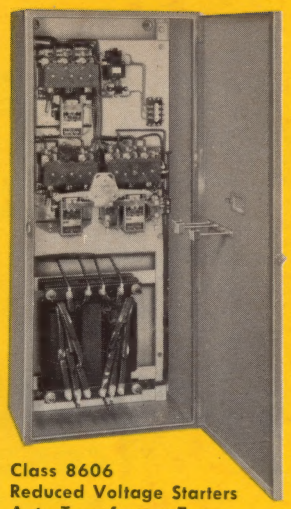
11. **Neutral Conductor.** A neutral conductor which carries only the unbalanced current from other conductors, as in the case of normally balanced circuits of three or more conductors, shall not be counted in determining current-carrying capacities as provided for in Note 8.

In a 3-wire circuit consisting of two phase wires and the neutral of a 4-wire, 3-phase system, a common conductor carries approximately the same current as the other conductors and is not therefore considered as a neutral conductor.

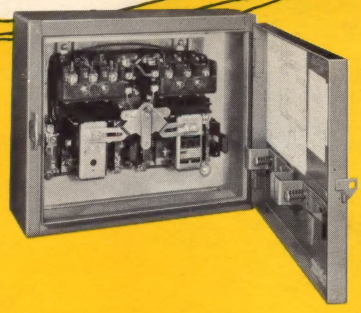
SQUARE D means Easy wiring! quick installation!



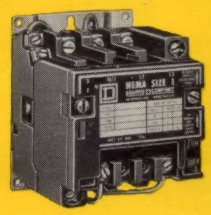
Class 8736
Reversing Starters



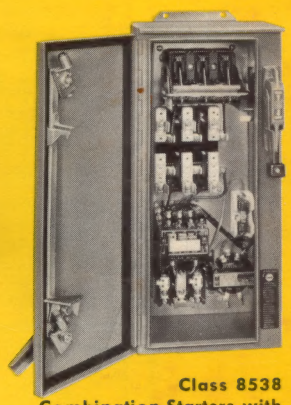
Class 8606
Reduced Voltage Starters
Auto-Transformer Type



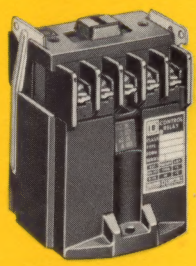
Class 8810
Two Speed Starters



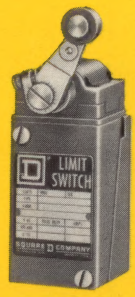
Class 8502
AC Contactors



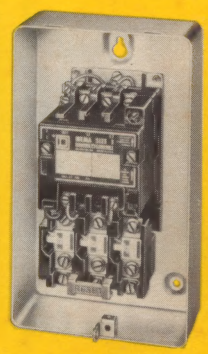
Class 8538
Combination Starters with
Fusible Disconnect Switch



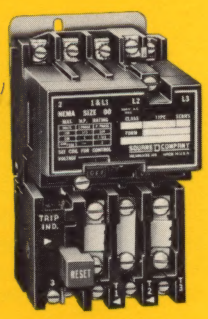
Class 8501
AC Relays



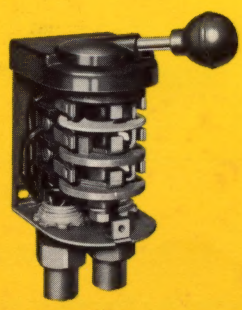
Class 9007
Limit Switches



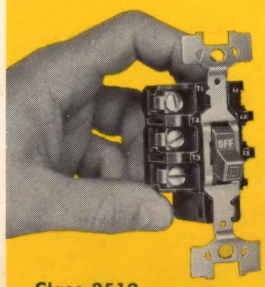
Class 8536
AC Starters
Sizes 0 and 1



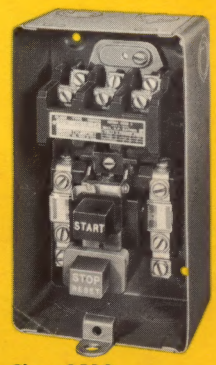
Class 8536
AC Starters
Size 00



Class 2601
Drum Switches



Class 2510
F.H.P. Manual Switches



Class 2510
Integral HP
Manual Starters

SQUARE D STARTERS ARE ESPECIALLY EASY TO WIRE AND INSTALL. HERE ARE 6 IMPORTANT REASONS WHY:

- Generous wiring space — no cramped corners to grope around in, light reflecting aluminum interior lets you see what you're doing.
- User's power and control connections made to separate terminals free of factory wiring — all terminals accessible *from the front*.
- Pressure type connectors save time, provide tight, low resistance connections — no need for special wire forming tools.
- Wiring digrams, similar to those found in this manual, are provided in the cover of every device, eliminating guess work in wiring.
- Factory installed wiring conforms to NEMA standards.
- NEMA standard terminal markings are clearly imprinted on contact blocks — not on terminal screws which could become lost.

For more information on devices shown in this manual — or on the many other types offered — consult your local Square D field engineer.

Bulletin SM-304R2-MMC-1-67 (Rev.-12/67)

SQUARE D COMPANY